‘Our power rests in numbers’

The role of expert-led policy processes in addressing water quality: the case of peri-urban areas in the national capital region of Delhi, India.

Timothy Karpouzoglou

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Timothy Karpouzoglou

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Summary

This thesis explores the role of expert-led policy processes in addressing water quality. It does so by drawing on the 'peri-urban' as a setting which exemplifies contemporary social and environmental challenges associated with river and groundwater pollution, as well as the health and livelihood implications for the poorest citizens in peri-urban areas. The peri-urban area of Ghaziabad, on the outskirts of New Delhi, provides a good reference point for understanding those challenges, while India's environmental regulatory agency (the Central Pollution Control Board) demonstrates how policy experts influence such a setting by enacting their institutional role and mandate.

The thesis examines the ways in which problems associated with deteriorating water quality in peri-urban areas are often neglected in expert-led policy processes, and the consequent implications for peri-urban poor communities. It argues that expert-driven policy approaches to addressing water quality are formulated almost exclusively on scientific grounds, while underlying 'non-scientific' decisions and choices, emerging from actors operating at levels from policy framing to policy implementation, are not awarded the same importance, thus ignoring issues that pertain to the social, environmental and political implications of the problems.

By drawing on qualitative research, the thesis focuses on two case studies. One examines the Central Pollution Control Board's framing of policy initiatives while the other follows the implementation of such policies in peri-urban Ghaziabad. The thesis demonstrates how the scale of monitoring water quality is heavily biased towards national rather than local level priorities. This leads to an understatement of important water quality problems that affect peri-urban areas in favour of large-scale analyses of pollution in river basins. This has the effect of understating important water quality problems that affect peri-urban areas in poorer localities such as villages within the Ghaziabad district. The centrality of technical discourses in the articulation *of* and response *to* water quality problems makes it difficult for non-technical perspectives (derived directly from those people who are exposed to pollution) to feed into formal decision-making. This research also identified the key influence of a number of actors (municipal engineers, public health officials and district magistrates) in shaping and implementing policy outcomes on the ground in local contexts (i.e. peri-urban areas), even though their roles are often not recognised formally.

The thesis is original in its attempt to merge insights from policy studies and science technology studies (STS) and apply them to the domain of water quality, a field that has not traditionally been subjected to critical social science inquiry. It also unpacks ethnographically the Board's dual role as both a policy advisor and regulator, and further illustrates how the enactment of these roles can lead to contradictory outcomes on the ground, particularly for the poorest peri-urban citizens.

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BOD	*Biological Oxygen Demand*
CGWB	*Central Groundwater Board*
CPCB	*Central Pollution Control Board*
DBU	*Designated Best Use*
EIA	*Environmental Impact Assessment*
EPCA	*Environmental and Pollution Control Authority*
ESRC	*Economic and Social Research Council*
GAP	*Ganga Action Plan*
GDA	*Ghaziabad Development Authority*
IDSP	*Integrated Disease Surveillance Programme*
IIT	*Indian Institute of Technology*
MoEF	*Ministry of Environment and Forests*
NCR	*National Capital Region*
NCT	*National Capital Territory*
NEPA	*National Environmental Protection Authority*
NGO	*Non-Governmental Organisation*
PAMS	*Pollution Assessment, Monitoring and Survey*
PCC	*Pollution Control Committee*

PCI	*Pollution Control and Implementation*
PCP	*Pollution Control and Planning*
PIL	*Public Interest Litigation*
RTI	*Right to Information*
SPCB	*State Pollution Control Board*
STEPS	*Social, Technological and Environmental Pathways to Sustainability.*
STP	*Sewage Treatment Plant*
STS	*Science and Technology Studies*
UP	*Uttar Pradesh*
UPPCB	*Uttar Pradesh Pollution Control Board*
UPSIDC	*Uttar Pradesh State Industrial Development Corporation*
WHO	*World Health Organisation*
WTP	*Water Treatment Plant*
YAP	*Yamuna Action Plan*

Nature, we suppose, is uniform: another researcher carrying out the same procedures, even on another continent or in another century, should obtain the same results. Such a principle, though, counts for little unless it can be instantiated in practices

Porter (1995: 13)

Chapter 1 Introduction

In recent years a number of scholars have turned their attention to water, and to understanding the inherently politicised nature of its distribution, commodification, regulation and use (cf. Bakker, 2003, Swyngedouw, 2004, Baviskar, 2007). A growing body of literature on water also recognises that although 'water' is traditionally viewed in techno-managerial terms there are also other important meanings and 'constructions' of water emanating from the local community level and civil society, whose roles in policy processes are often not fully recognised (cf. Mehta, 2005, Mosse, 2005). So far, however, the emphasis in the literature has been on issues relating to access to water whilst water quality has not received as much focused attention and is often situated at the margins of the growing water debate.

More focused research on water quality appears to be timely as well as relevant to existing water debates. The research and international policy community have already begun to identify a broad range of contemporary challenges posed by poor water quality. For instance, a recent report on wastewater management that was jointly researched and written by the United Nations Environment Programme (UNEP) and United Nations Habitat (UN-Habitat) has put forward the view that because of continuing population growth, urbanisation and intensification of food production, 'the world is facing a global water quality crisis' (Corcoran *et al.*, 2010). As a consequence, the adverse environmental implications associated with the disposal of large quantities of untreated sewage and other effluents in rivers and groundwater have increased, as well as the number of people whose health is at risk from the contamination of the drinking water supply by human, industrial and agricultural waste (Murty, 1995).

With more than half of the world's population currently residing in growing megacities (such as in China, India and Brazil) with populations exceeding 8 million (Davis, 2004), many of these challenges are known to affect urban and peri-urban areas in developing countries. Particularly in growing peri-urban environments characterised by increasing marginalisation and environmental degradation (Marshall *et al.*, 2009), water quality poses a very real and complex challenge for livelihoods and the environment. Water pollution caused by the largely unregulated disposal of industrial effluents and domestic wastewater places enormous pressures on local water resources (Satterthwaite, 2007).

Impaired quality of local water sources in turn has a much more severe impact on poorer communities that lack access to alternatives (such as piped water) and have to resort to using contaminated water to meet their basic water needs. According to the WHO, at least 4% of the global disease burden could be prevented by reducing people's exposure to unsafe water (WHO, 2009: 12). For these reasons, international fora such as the recent 2010 Stockholm World Water Week are attempting to develop greater awareness of the multifaceted nature of water quality, involving both a 'human' and 'environmental' dimension (SIWI, 2010).

However, solutions to complex water quality problems are commonly perceived to lie almost entirely in major investments within a narrow range of engineering solutions, such as large scale wastewater and water treatment technologies (WSP, 2011). As a consequence of this, formal policy interventions have had only a small impact on the improvement of water quality in local contexts where the impact is often felt more severely by the poorest populations. Specifically, in developing economies like India (which is the focus of the greater part of this thesis), scientific and engineering knowledge is invariably and deeply involved with the framing and implementation of policies to deal with water quality, but also other policy areas such as natural resource management, environmental conservation and urban planning (Prakash, 1999). The strong ties that are formed between policy making and expert knowledge are often treated more critically by scholars because such knowledge can fail to take sufficient account of the interests of the poor in decision making processes (Fairhead and Scoones, 2005, Movik and Mehta, 2009). Following from that, it is this thesis' aim to explore the relationship between expert knowledge and water quality management on the basis of selected case studies in India. The approach adopted is intended to develop deeper insight into how expert knowledge is used to respond to emerging challenges regarding deteriorating water quality.

The first case study of the thesis aims to contribute to such discussions by analysing the role of expert advisors (i.e. scientists and engineers) working within India's environmental regulation agency called the Central Pollution Control Board (for short, the Board). This is of particular interest due to the Board's dual role as both policy advisor and regulator, influencing both the framing of policy decisions and their execution and enactment in the public and political realms. The advisory role of the

Board mobilises scientific expertise and 'know-how' in order to propose policy responses to environmental problems, while its regulatory role has a direct bearing on the actual decision-making process, functioning as a validated, respected and prestigious scientific arm of the Indian Ministry of Environment and Forests (MoEF). Drawing upon the work of scientists at the Board, the study hopes to deliver a more grounded understanding of scientific practice in India's environmental regulatory institutions, and a better understanding of how scientists influence 'official' perceptions of water quality at the policy level. Some of the central themes with which this thesis will be concerned include how scientists define water quality, the policy priorities and interventions which tend to be inferred from the Board water quality assessments, and the unarticulated assumptions that shape relationships between experts and different stakeholder groups (including NGOs, poorer citizens affected by poor water quality, policy makers and government officials).

The second case study contrasts the work of scientists at the Board with the way in which water quality problems manifest in especially challenging environments of the Global South, epitomised by peri-urban areas. Ghaziabad district, situated in the periphery of Delhi, is one such area. It is characterised by a complex array of water quality problems arising from the contamination of the groundwater, the environmental degradation of the local river Hindon and the fragmented provision of water supply and wastewater management services. The use of Ghaziabad as a case study is supported by a range of empirical observations of the local realities of impaired water quality. It enables valuable inferences to be drawn from the differences between the framing of policies at the national level (i.e. through the involvement of the Board) and the translation of these policies in peri-urban areas by multiple actor groups such as district officials, the regional pollution enforcement agency, and the water and health departments.

Drawing insights from these two case studies, this study hopes to provide more general theoretical explanations of the use of expert knowledge to address impaired water quality. It is argued that although expert knowledge takes a major role in decision making processes relating to water quality management, it can underplay (or at times

completely overlook) critical issues in terms of pollution sources[1] that are currently having the most (and potentially increasing) impact on the environment and the lives of poorer social groups. In addition, it is demonstrated that heavy reliance on technical notions of water quality can obscure the underlying inequalities and power relations that influence how the impact of deteriorating water quality is distributed across the population.

In the sections that follow, the thesis briefly set the context, first by explaining how urbanisation and peri-urbanisation is taking place in India, and specifically in the context of New Delhi. Next it illustrates that urban change and peri-urbanisation pose a unique set of challenges for addressing water quality, and that a better understanding of these challenges requires a more careful analysis of the politics of knowledge and the underlying power relations which guide policy interventions. It then briefly explains the limitations posed by formal expert knowledge, closing with the research questions that guide this thesis and a brief outline of subsequent chapters.

1.1. Drivers of urban change in India

The social and environmental transformation of Delhi's periphery is closely tied to wider changes taking place in India, such as those related to urbanisation, population growth and economic neo-liberalisation. In this context, Delhi is considered one of the fastest growing metropolises in South Asia. According to the Delhi Master Plan for 2021, the urban core of Delhi, also known as the National Capital Territory (NCT), is highly urbanised with more than 90% of its population living in urban areas (i.e. far greater than the national average of 27.81%)(MoUD, 2007: 7). In addition, a continuation of the current demographic growth rate of nearly 4% per year (Kundu, 2008: 45) suggests Delhi is one of the fastest growing cities in the country, with the projected urban population reaching 17.6 million people by the year 2015 (Ansari and Einsiedel, 1998: 3). Other Indian cities are also experiencing very high rates of urbanisation. By 2025, an estimated 70 Indian cities are expected to have a population exceeding one million. Three mega-urban regions: Mumbai–Pune (50 million), the

[1] One particularly widespread source of pollution comes from small scale factories, which are increasingly found to operate illegally in peri-urban areas.

national capital region of Delhi (more than 30 million) and Kolkata (20 million) will be among the largest urban concentrations in the world (Dyson and Visaria, 2004).

The growing number of large Indian cities further reflects the region's growing importance within the world economy, along with China and Africa. During the period 2000 - 2005, India contributed nearly one fifth of the growth in Asian domestic demand, and it is expected to be the second largest demand driver in Asia, after China (Purfield and Shiff, 2006). Indian corporates are also emerging as key players in their own right. For instance, Reliance enterprises own one of the world's largest oil-refining complexes, and Tata Steel is amongst the world leaders in steel manufacturing; both enterprises have expanded abroad in the United States as well as in several countries in Europe and Africa (ibid). Urban India overtook rural India in its share of GDP in the late 1990s, and urban per capita incomes are now more than three times those in rural areas (CSO, 2006).

This unprecedented growth of cities in India has not remained unaffected by changes affecting the urban landscape worldwide. The evolution of capitalism, the decline of Fordist production as a dominant mode of accumulation and the increasing globalisation of markets as a result of technological change have combined to transform large cities into economically strategic places (Sassen, 1994). As a consequence of this restructuring there has been an intensification of connections between the world's largest cities, or 'global cities'[2] (Sassen, 2000: 80), in terms of flows of raw materials, goods, information and capital (much of it managed by transnational corporations) (ibid). As Davis argues, such changes taking place in cities today should be viewed as a consequence of the 'brutal tectonics' of neoliberal globalisation (Davis, 2004: 23). Emerging megacities situated in developing societies, including Delhi, are perceived to have an important role in enhancing neo-liberalism. Indeed, since the 1990s multilateral aid agencies such as the International Monetary Fund and the World Bank, through their Structural Adjustment Programmes, have increasingly focused their attention on cities in developing economies, which are perceived as 'engines of growth', and therefore

[2] Saskia Sassen coined the term 'global city' to describe how the massive trends towards the spatial dispersal of economic activities at the metropolitan, national, and global levels that we associate with globalisation, are mediated by a relatively small proportion of the world's cities such as London, Tokyo and New York. Whilst the majority of world cities are situated in developed economies, trade liberalisation and urban population growth in cities of the Global South suggests that an increasing number of global cities are also emerging rapidly within developing economies (Sassen, 2000).

directing substantial funds into urban 'infrastructure' and other service delivery mechanisms in order to facilitate this role (Kennedy and Zérah, 2008:110).

For Neil Smith, neo-liberalism has provided an operative framework for the gentrification of the city (Smith, 1982). It has encouraged the state to re-organise urban space, displacing older, lower-value and historical land uses to make way for newer capital-intensive developments that can attract capital and fix it in physical infrastructure and land (ibid). As part of this process, an industrial economy is being transformed into a service based economy, while activities that are deemed undesirable are displaced into the peripheries, or relocated to marginal and unprofitable parts of the urban centres. A significant increase in the cost of living is another factor associated with gentrification, contributing to the displacement of the poorer urban residents that are unable to afford increased rents or house prices.

In India, this mode of urban development has been pursued through the implementation of policies such as the Floor Space Index (FSI), which permits vertical growth in parts of the city with high land values (Kundu, 2002). This has been a huge incentive for major real estate developers to invest in Indian cities and to construct a plethora of high rise buildings, including multi-storied structures such as shopping malls, office blocks for business groups, and high-income residential houses. Special Economic Zones (SEZs) are another government-led project established to attract capital into cities. They were created to increase the availability of land for private Information and Communication Technology (ICT) companies, both domestic and foreign, to set up exclusive business enclaves on the peripheries of big cities (Ramachandraiah and Srinivasan, 2011). As a result, plans for the construction of ICT 'parks' such as Pritech Park (Mumbai), Shastri Park (Delhi) and 'cities', such as HiTec City (Hyderabad) and Electronic City (Bangalore), are being considered in several cities in India, while several SEZ projects are already complete (ibid).

Alongside these developments, there has been a shift in the role of the Indian state from provider to facilitator and the welfare state is starting to be dismantled (Patnaik, 2007). Large infrastructure projects have been undertaken in key sectors such as electricity, water, sanitation and transport, through public/private partnerships, the outsourcing and contracting out of several functions of urban local governments (ibid)(Ramachandraiah

and Srinivasan, 2011). In the context of the urban transport sector, for instance, there has been massive financial investment in widening roads, constructing numerous flyovers, and, in Delhi, in the construction of the Delhi Metro Rail mass transit system (i.e. the first underground transport system in India)(Roy, 2004). For the burgeoning neo-liberal Indian state, allocation of lands and financial incentives to the private sector, as well as the construction of large infrastructural projects, are thus considered to be part and parcel of a policy to promote economic growth in an era of globalisation (Ramachandraiah and Srinivasan, 2011).

However, such large investments in urban infrastructure have also been widely criticised for their distinct lack of attention to the urban poor working in Indian cities and living in slums and low-income settlements. In an analysis of the Delhi transport reforms, for instance, Siematycki argues that despite the positive 'world class' image of the city that the Delhi metro project aspires to create, it has in reality undermined the right of the urban poor to a genuinely 'public' transport service (2006:285) . This is due to a focus on increasing transport connectivity between affluent neighbourhoods, and by displacing slums for road and rail construction. Banerjee-Guha arrives at similar conclusions in an examination of the Mumbai Metropolitan Region Development Plan and other government policies on a range of urban reforms taking place in Mumbai. She argues that although 'the proposed plans aim to realise the immense opportunities offered by Mumbai's role as an international business and financial centre, they fail to address the 60 percent of the population who live in slums and an even higher percentage who form the teeming multitude of unorganised workforce' (2002:125). Such criticisms highlight the increasing inequalities between social classes in urban India which are often neglected by city planners and urban developers, yet are inherent to the process of global city development (Shatkin, 2007).

The 'invention' of a new Indian middle class has been fundamental to the emergence of a wider national political culture of a liberalising India, which has opened its borders to a range of consumer goods that were unimaginable before the economic reforms of the 1990s (Fernandes, 2004:2044). As a result, in the management of urban space, much of the emphasis of the state has been on the wealthier middle class segments and the aspirations of the rich to inhabit sanitised urban spaces (Baviskar, 2003). This middle class bias in the planning of Indian cities has become enmeshed in complex socio-

spatial contradictions. Poorer sections of the population are integral to the urban economy. They provide essential services, including street cleaning, working in factories and on construction sites, or providing domestic help in the homes of the rich and the middle classes. Despite this, they are deemed undesirable and commonly forced to live in unauthorised settlements and slum areas. In the city of Delhi, for example, nearly 52% of the population lives in such settlements, and the situation is not very different in several other Indian cities (Narsiah and Ahmed, 2012). As Fernandes argues, these contradictions have emerged first through a 'politics of distinction' of the middle classes, and followed by a 'politics of forgetting' of the poor and working classes in the process of liberalisation (Fernandes, 2004).

The state, with its monopoly, and the means of violence and the power to define legality, plays a crucial role in legitimising and further promoting these processes (Harvey, 2004). For instance, in Delhi, between 1990 and 2003, 51,461 houses were demolished under 'slum clearance' schemes that were endorsed by the Delhi city authorities (Hazards Centre, 2003). And thereafter, in the period between 2004 and 2007, at least 45,000 homes were demolished. Fewer than 25 percent of the households evicted in that period were allocated any alternative settlement sites (ibid). These massive displacements of populations from the urban core are inextricably linked to the larger political, economic and aesthetic transformations taking place in Indian cities.

For instance, the removal from the bank of the Yamuna River of a string of settlements (colloquially known as 'Pushta')[3] is one of the numerous cases of slum clearances that have been justified on the grounds of urban renewal and development. In January 2003, the Indian Ministry of Tourism announced a plan to redevelop a 100-acre of strip of publicly owned land on the banks of the Yamuna River into a riverside promenade. Between February and April 2004, and after several 24-hour long operations involving armed police officers and bulldozer crews, the homes of nearly 35,000 families in Pushta were razed to the ground (Bhan, 2009). The eviction of the Pushta settlement residents received very little coverage in the media, while the involvement of the Delhi High Courts played a crucial role in legitimising the eviction operations, often by ruling in favour of appeals filed by middle class residents' welfare associations and trade

[3] The majority of residents were daily wage workers, rickshaw pullers, domestic workers and recyclers who had migrated to Delhi for work, or had been brought by contractors to build infrastructure for the Asian Games in 1982(Bhan, 2009).

associations. Bhan further notes that these recent eviction strategies further mark an ideological shift in the judiciary since the adoption in the early 1990s of liberalisation policies that have resulted in reduced enforcement of the rights of marginalised groups (ibid).

More recently, slum clearances in Delhi have become enmeshed with a 'bourgeois environmentalist' discourse (Baviskar, 2002: 41) mobilised by middle-class interest groups in courts to remove from the city the 'aesthetically unpleasant' sight of slums, and of factories that provide incomes for a large number of poor urban workers. Similarly, in Mumbai, Zerah describes how environmentalists sought to have the poor cleared from Sanjay Gandhi National Park on the grounds of promoting the beautification and environmental preservation of the park premises. The poor were blamed in court for destroying the environment of Sanjay Gandhi National Park, while the rich and middle classes were never considered to be part of the problem (Zérah, 2007:122). This was irrespective of encroachment on the park's reserves for middle class uses such as industry, restaurants and large residential bungalows.

As the next section will demonstrate, the fact that certain social groups and activities are deemed undesirable within the urban core has a direct bearing on the type of roles and activities that are often characteristic of the peri-urban. In the context of this research, it is further understood to be an important driver of the various manifestations of environmental degradation, such as deteriorating water quality, which are becoming increasingly more acute in peri-urban areas as compared to the inner metropolitan region.

1.2. The peri-urban challenge: social and environmental transformations in Delhi's periphery

There is at this present juncture a growing body of research that attempts to conceptualise peri-urban areas. The term 'peri-urban' is often used to describe the rural fringe areas that surround cities and bear the consequences of urban expansion (Iaquinta and Drescher, 2000). However, in the peri-urban literature it is difficult to find one single definition of the term, as different definitions can apply depending on the circumstances. In some of the earlier work on peri-urbanisation, it is the proximity of the peri-urban to the city and the mixed rural-urban populations and land uses that seem to define the peri-urban, or as Ramachandran argues, 'the point where agricultural land uses appear near the city and villages have distinct urban land uses' (Ramachandran, 1989:297). More recently however, a number of scholars have moved away from a 'place based' definition, arguing that proximity to towns is not the single most defining characteristic; rather it is the linkages and flows of goods and services between rural and urban centres, as well as the institutional contexts that underpin them (Douglas, 2006). As a result, definitions of the peri-urban increasingly tend to return to a 'process' based description, as opposed to one that denotes a place with well-defined geographic boundaries (Narain & Nischal., 2007).

In the proximity of the mushrooming South Asian cities, the peri-urban is increasingly seen as the product of deeper structural transformations in society. What is particularly relevant to an examination of the peri-urban in Indian cities is the acknowledgement that the complexity and heterogeneity that mark peri-urban spaces have been underlined increasingly by globalising imperatives, and growth which is brought about largely by outside forces (Thong, 1995, Arabindoo, 2006). The liberalisation of the Indian economy followed by a need to envision the city as a world-class centre for global capital, discussed in the previous section, is one such transformation. It has had a massive impact on the urban periphery by adding greater complexity to the relationship between the city and its periphery, and creating new forms of segregation, polarisation and socio-spatial fragmentation between the previously established village settlements and the more recent settlements of both the urban rich and middle classes (Arabindoo, 2006: 24). That is why Arabindoo further argues, the peri-urban presents 'a much richer

mix of varied elements that appear to oscillate between their desires and compulsions of homogeneity and heterogeneity' (ibid: 25).

The peri-urban agglomerations and townships of Ghaziabad (i.e. the subject of Chapter 5), Gurgaon, NOIDA and Faridabad, on the outskirts of New Delhi, have been influenced in a number of ways by the mode of urban development shaping the capital. The Delhi Master Plan for 2021, which outlines the government's vision for the city, mentions that, 'Delhi…is a growing and expanding magnet of attraction for people from all across the country *and also* a hub for the region surrounding it' (MoUD, 2007: 5) indicating the aspiration of city planners to associate the periphery with the capital. Similarly, the Ghaziabad Master Plan 2021, for instance, complements the vision of the regional plan of Delhi, stating that 'any city located in the proximity of a large metropolis such as Delhi cannot be oblivious to developments taking place in the larger city' (Ghaziabad Development Authority, 2006: 3).

This aspiration to foster 'interdependencies' between the city and its periphery has also encouraged various antagonisms. In Gurgaon, out of 700 acres of what was previously cultivated farmland, about 500 acres have been acquired by agencies of the state, and 100 acres have been voluntarily sold to private builders and property dealers (Narain, 2009). In line with the principles of liberalisation, the purpose of these land acquisitions was to construct middle class residential colonies, shopping malls and corporate houses. Similar developments are about to happen in other parts of Delhi's periphery, such as NOIDA and Ghaziabad. With the cost of buying property in Delhi increasing rapidly, many middle class households are moving to the periphery and commuting to Delhi for work as a more economically viable option than buying property in the capital (Kundu, 2002). This is supported by easier travel between the city and the periphery as a result of the construction of rapid transport corridors such as motorways and railroads (but only for those peri-urban localities where new commercial and residential developments are taking place) (ibid).

Real estate companies and state agencies, taking a cue from these developments, perform the role of surrogate landlords, using revenues to buy more land in the peripheries which can then be sold on to the private sector and potential home buyers (Arabindoo, 2005). In the short term, some villagers with large land holdings benefit as they are paid large sums of money in return for their land. However, Narain's observations in the context of Gurgaon suggest that in the long term the conversion of land from agricultural to non-agricultural purposes has spawned a consumerist culture and led to the loss of livelihoods for many of the landless and migrants who either live as tenants in the villages and commute to the city to work as low paid labourers, or work for the farms of the village landlords (Narain, 2009).

A vision of urban development that focuses on the remaking of Delhi into a global city has also meant that the social and environmental costs associated with urbanisation have become very unequally distributed between the urban core and its periphery. A series of developments to 'beautify' the city, culminated in Delhi becoming a host for the 2010 Commonwealth Games (Ghertner, 2008) while the peri-urban areas surrounding Delhi were transformed into the 'wastelands' of development taking place elsewhere. The large-scale removal of unauthorised colonies, such as the clearance of the 'encroaching' Pushta settlements from the Yamuna River (discussed in the previous section), was closely linked to the pursuit of city beautification policies. Many of the poor that were displaced from Delhi have resettled into a number of urban villages in the periphery. In addition, since 1996, numerous PIL-based court orders in Delhi have further forced the closure and relocation of hundreds of factories from residential neighbourhoods of Delhi (Navlakha, 2000). Once again the peri-urban has become the main receiver of those units, many of which - despite being grossly polluting - are allowed to operate with little or no adherence to environmental regulations.

It is further noted in the literature that while environmental degradation is not necessarily new to the peri-urban (or indeed to the urban core), it has accelerated since the 1990s when the pursuit of a neoliberal vision of urban development was initiated (Arabindoo, 2005). Development and planning documents have played an important role in disguising environmental pollution problems affecting the peripheries. On the one hand they showcase only those areas and activities that are viewed as 'profitable' or are implicated with Delhi's redefined role as world-class city, namely the development

of exclusive residential colonies, commercial centres and industrial complexes. On the other hand, they overlook the specificity of the peri-urban both in terms of its mixed rural and urban ecological features and the diverse social structures that underpin them (Sharan, 2011, Allen, 2003). These problems are further compounded by the tendency of the peri-urban to exist in a regulatory and planning vacuum, influenced by a city planning culture of 'tolerating' environmental pollution in the periphery while striving to maintain the inner urban core pollution-free (Allen, 2003: 136).

The neglect of the peri-urban is partly a reflection of the power relations at play and the growing tendency of urban planners, policy actors and city based environmental campaigners to prioritise middle class and elite interests. Curbing pollution in the city (e.g. by conserving particular environmental resources such as the Yamuna floodplain) is often presented as being in the 'public interest' (Veron, 2006). But as Veron notes, 'because the actions of environmental groups and governmental agencies are often segmented, departmentalised and limited to one or two resources, they have the unintended consequence of both including and excluding particular environments in and from the public realm' (Veron, 2006: 2097). Thus, environmental plans are drawn up on the basis of promoting a middle class aesthetic of what constitutes a 'clean' environment and have redefined an overtly sanitised vision of Delhi, whilst neglecting the environmental consequences of this vision for the towns and regions that surround it.

A direct consequence of these processes is that environmental degradation in peri-urban areas is often acute and marked by multiple and often overlapping ecological, social and health effects. It entails, for instance, pollution impacts on both land and water arising from the transfer of polluting industries to the periphery, and the associated toxic chemicals and hazardous wastes that are associated with these industries. In Ghaziabad, which is one of the case studies for this thesis (discussed in Chapter 5), industrial pollution is seen to pose a serious risk for human health because of the water contamination associated with the unregulated disposal of industrial wastes into the groundwater and river bodies. Other ecological effects are related to the shrinking of common land and the loss of productive farmland due to real estate developments (Dupont, 2005, Narain, 2009). This is the case in peri-urban Gurgaon, for instance, which has experienced large changes in the use of land (i.e. conversion from farming to

residential and commercial uses). Furthermore, the lack of water and sanitation facilities also represents an environmental problem, since domestic sewage adds to the pollution burden of already constrained water resources (Marshall *et al.*, 2009).

In this new geography of pollution and environmental degradation, the costs of pollution tend to be borne by economically and socially marginalised groups. In peri-urban areas these costs are likely to be further magnified because of the multiple and escalating environmental pressures in these areas, including those previously observed to have an impact on the poor within traditional city boundaries. Examples include inadequate access to basic health, water and sanitation services (Birley & Lock., 1998, Allen *et al.*, 2006), and also the environmental costs associated with the fact that the peri-urban is a fuzzy regulatory zone increasingly subjected to more pollution from hazardous industrial activities and the illegal dumping of toxic wastes (Singh, 1998, Parkinson and Tayler, 2003). Marginal populations are at an increased risk of direct exposure to diverse pollutant sources (i.e. domestic as well as industrial waste pools) and indirect exposure via an intricate chain of pollutant pathways (i.e. exposure to heavy metals and air pollutants via dietary intake) (Singh *et al.*, 2010).

In a peri-urban context, unequal power relations and the vested interests of local planners and politicians (who seek to profit from the sharp increase in the value of land in Delhi's peripheries) tend to underpin the fact that little attention is paid to the environmental priorities of poorer peri-urban groups. That is why Moffat and Finnis identify land ownership as a key driver of how power is negotiated in peri-urban spaces (Moffat and Finnis, 2005). As the city grows and the influence of the capital over the periphery is increased, poorer groups such as squatters and village residents see their entitlement to land being rapidly diminished. Tenure insecurity in turn means that poorer social groups have limited power when attempting to negotiate with municipal governments and environmental planning bodies regarding their own lack of services and exposure to pollution (this is again explored in detail in Chapter 5, which discusses the Ghaziabad case study).

The fact that the environmental interests of the poor tend to be ignored in a peri-urban setting raises further questions around how citizenship is constituted in peri-urban areas, particularly as there are heavily biased official positions regarding which citizens are considered legal or illegal, or indeed which citizens are deemed more deserving in terms of access to a clean environment (Ramanathan, 2006). The exposure of the poor to deteriorating water quality is fraught with its own particularities, and these are explored throughout the thesis. However, water quality is also a challenge that cannot be seen in isolation from these wider peri-urban environmental transformations.

Having described some of the underlying causes of environmental degradation in peri-urban areas, and highlighting that these are linked to changes taking place not just in the peri-urban sphere but also in the city, I will take up the issue of deteriorating water quality as the focal point of this study.

1.3. Different dimensions of water quality

The deterioration of water quality as currently experienced in many cities of the developing world is ultimately tied to rapid urbanisation, industrialisation and accelerated population growth. These wider transformations have placed added pressure on already inadequate and often poorly designed water, sanitation and wastewater infrastructure, which has in turn exacerbated water pollution in cities worldwide. Delhi alone, for instance, has 40 per cent of the total sewage treatment infrastructure of the country, yet only 45 per cent of the sewage generated is treated, while the rest is discharged directly into the river and local water bodies (CPCB, 2004). In many developing countries industrial waste is also a significant contributor to water pollution, with more than 70 percent of industrial waste dumped untreated into waters, where it pollutes the usable water supply and poses a threat to freshwater and coastal ecosystems (Corcoran *et al*., 2010). Poor quality water is increasingly viewed as one of the greatest health challenges, with at least 1.8 million deaths per year linked to water related diseases (WHO, 2010).

Observation of the above trends, however, is often based on aggregate assessments of deteriorating water quality. A less explored dimension of the water quality crisis which is pursued in this thesis is one that examines not only the challenges faced as a consequence - or merely an 'externality' - of urbanisation and development, but equally a challenge which requires a more careful conceptualisation of power and politics. This is a line of enquiry that has been applied, for instance, to the study of water as a resource of both consumption and production. Mehta approaches her analysis of water from a critical socio-political perspective and arrives at the conclusion that supplying water and sanitation services to urban and peri-urban areas often has less to do with actual water availability than with struggles over access to and control over a finite resource (Mehta *et al*., 2007). Swyngedouw's analysis of water from the perspective of Marxist political ecology further reinforces this point, highlighting that because urban transformations under the current political and economic structures of capitalism (such as those exhibited in Indian cities) are often uneven and unjust, access to natural resources such as water can be highly unequal, with the urban poor being largely excluded from even a basic level of water provision (Swyngedouw, 2004). For others such as Bakker, specific policy trends in the water sector can reinforce inequalities. In particular, in the urban context the trend towards the commodification and privatisation of water resources, although advocated as a solution to the former inefficient water and sanitation infrastructure, has largely failed to extend water supply to poor urban households. Moreover, it has even been counterproductive when extended to low income regions that have already established alternative community economies of water (Bakker, 2003).

Although the socio-political analysis of water has now become an established research field, water quality has largely been devoid of this type of analysis. In particular there has been limited attention to inequalities in the distribution of water pollution and how these are likely to vary according to location, class and economic status. Perhaps, as Kelly Alley notes, it is the culturally neutral, mundane image of waste flows that has failed to engage the interest of social scientists (2002: 24). However, the social disparities in exposure to waste and water pollution observed in a peri-urban setting suggest that water quality management should be taken more seriously and researched in a more rigorous manner.

One point that is clearly emerging from ongoing research is that the peri-urban poor are more likely to be exposed to poor water quality than more affluent citizens who reside in the same region, but in colonies that are far better served by established sanitation facilities and access to safe drinking water, and better recognised formally by the state (Randhawa and Marshall, 2010, Sharan *et al.*, 2010). For peri-urban authorities it is often not a priority to bring environmental services and sanitation technologies to the poor, so their physical exposure to contaminated water is increased and they are induced to reside in marginal or ecologically vulnerable areas (Birley & Lock., 1998, Davilla *et al.*, 1999). As a result the health impacts of exposure to and consumption of poor quality water across these populations can often be dramatic: it is often associated with common diarrhoeal diseases (such as cholera and typhoid) (Sharma *et al.*, 2003) as well as longer-term impacts from heavy metals with carcinogenic potential, which have been found in groundwater extracted for drinking purposes (Singh, 2006). The distributional inequalities in exposure to water pollution are further linked to the changing character of the peri-urban and the transfer of environmental pollution to the periphery.

Embedding water quality in a socio-political framework also necessitates an appreciation of the wider political economy of water access and use, as opposed to deteriorating water quality being seen solely as a problem of environmental pollution. In a peri-urban setting water pollution can travel in ways that are largely uncontrollable. It can pose a threat to the wide array of arrangements operating on the basis of solidarity, reciprocity or need, where water is accessed through non-conventional and officially unrecognised means (Davilla *et al.*, 1999, Allen *et al.*, 2006).

For instance, water for drinking and other domestic uses such as food preparation, hygiene and sanitation are usually met by the peri-urban poor through informal, unofficial means of water allocation (Allen *et al.*, 2006). A broad range of individual and collective solutions are deployed, which may include informal tapping into the mains lines supplying water, using submersible pumps to extract water from the groundwater (this is quite common in the field sites examined as part of this study) or accessing water from water tank trucks and bottles (Randhawa and Marshall, 2010). Increasing numbers of informal vendors and small-scale private entrepreneurs have been able to profit from the obvious lack of state water provision by selling bottled water at high prices to poorer peri-urban populations (Solo, 1999). However, because

these water allocation strategies are often operating in the absence of a clear regulatory framework and under ambiguous water safety standards, 'water quality' cannot always be guaranteed (Allouche, 2011).

The thesis explores how the water quality associated with these largely informal water allocation practices might be compromised in peri-urban areas, and to what extent responsibilities for ensuring water safety are shared between citizens and the State. It does not deal directly with the role of informal water providers in peri-urban areas (as this is a large topic of intellectual inquiry in itself). It does, however, explore some of the key 'water quality' dimensions associated with informal water allocation practices. It further explores how the implementation of sector-based approaches (linked to water supply, wastewater treatment, and the amelioration of river pollution) accounts for those water quality problems that sometimes operate on the intersection of different policy agendas (Sharan, 2011).

Related to this, the study explores the environmental discourses and knowledge that tend to justify specific policies related to the control of water pollution, and examines whose interests and priorities are reflected in the lobbying for and implementation of such policies. For instance, in Delhi the alliance between middle-class interests and river quality concerns has led to a particular framing of the problem of deteriorating water quality. That is why a seemingly endless number of court cases has been filed against the government by activists such as M.C. Mehta and the NGO Paani Morcha, to push for the effective protection of the Yamuna River (Dutta and Peace Institute Charitable Trust, 2009). By contrast, the link between poor sanitation and water-borne disease, which is crucial for India's urban poor but not for its urban middle classes, has not been made a campaign issue (Chaplin, 2011). This in turn has been an important driver for the Delhi Jal Board (DJB, the city water authority) to focus investments purely on the extension of the sewerage network while neglecting the social dimension of the water quality crisis as it presents in the proximity of poorer urban households (Prasad, 2002). Similarly, in a peri-urban context, policy priorities for water quality management are likely to be influenced by the power relations which operate between different social groups and the type of knowledge which guides the actions of peri-urban water and environmental authorities (a point explored in Chapter 5 of this study).

1.4. Policy interventions, expert knowledge and official practice

The examination of the role of scientific knowledge and scientists in influencing decision making around water quality management is an important part of positioning water quality within a socio-political framework of study. Traditionally, water quality has been framed largely in technical terms, and as a result there is a tendency to replicate in peri-urban areas the heavily engineered solutions that were previously adopted in Western contexts to resolve their own water quality crises[4] (Keeling, 2005). These include a heavy emphasis on hydraulic engineering, the design of pollution limits (criteria and standards) and the construction of centralised water treatment plants, as well as optimisation and monitoring of treated water at existing technological plants (Datta *et al.*, 2001).

The limitations of relying solely on technological solutions are now beginning to resonate strongly within the research community. Large scale technological systems commonly require large capital investments, involve high maintenance costs, and depend on economies of scale to make them economically feasible (Frijns and Jansen, 1996). As a consequence, such systems can fail to reach the poorest and most marginalised populations, whilst typically serving middle class colonies that are able to afford running and maintenance costs (Parkinson and Tayler, 2003). In tackling challenges linked more closely to environmental sustainability, the implementation of large scale technological solutions has already come up against noticeable barriers. River restoration programmes in India, drawn up on the basis of increasing numbers of centralised wastewater treatment plants, have to date failed to deliver any significant improvements to the water quality of important river systems despite large financial investments in the sector (CSE, 2007). Furthermore, the capital intensity of these technologies and the costs of transportation and eventual treatment of waste before disposal are such that the improvements simply have not reached all users - or even all urban areas - affected by poor water quality (Kumar, 2003). But despite the shortcomings of the engineering approach, confidence in large-scale technological measures still prevails and is further associated with a deep reluctance to accommodate

[4] This point has been well substantiated by environmental historians who have focused on the links between colonial development, science and technology. The key shortcomings of transferring Western technological models to address water quality are explored in more detail in the literature review in Chapter 2.

the social mechanics of projects, such as mobilising communities and involving water users and people affected by the processes of implementation (Tova Maria Solo, 1993).

Part of the reason why it has been difficult for less capital-intensive solutions to gain momentum in policy processes is that scientists and engineers tend to occupy strategic positions of influence within government. Commentators have also argued that despite the emergence of a 'critical' voice in India, comprising social movements, civil society and environmental NGOs (Nandy *et al.*, 2001), environmental decision making in India has not been very progressive because of a predominant emphasis on expert perspectives (Menon and Kohli, 2008). For instance, the MoEF, like many other parts of government, has largely been hostile to the idea of NGO participation, and has not usually welcomed lobbying from, or dialogue with civil society (Vyas and Ratna Reddy, 1998). This position is also reflected in the MoEF policy guidelines, which adopt a definition of expertise which is rather limited to those with professional training in the 'engineering, technology and architectural' disciplines (MoEF, 2007: 1). This leaves little scope and few entry points for dialogue across other fields such as the ecological and environmental disciplines, the social sciences, or from representatives of local communities and civil society organisations (Open Letter, 2004).

Another issue, perhaps in some ways more pressing, is that the implementation of policies linked to water quality management in India has become heavily politicised and is often far more complex than just a matter of expertise. The nodal agencies that monitor and regulate water quality, the Board and State Boards[5], appear well organised on paper. However, in practice, they often have little power to take action against polluters. This is partly a result of the fact that in the context of India's neo-liberalisation, enhancement of the international competitiveness of its industrial sector is perceived by many of India's top policy makers as a higher priority than investing in pollution abatement (Stuligross, 1999). A pro-industry outlook has in turn meant low levels of monitoring compliance of polluters by the Boards, as well as little practical influence over the policy agenda of other Ministries (ibid). Scientists therefore have to

[5] The Board and State Boards are the main organisations that have a formal mandate for water quality management. The main difference between the two institutions is that according to the federal system of governance in India the Board operates at the national level while State Boards operate at the 'state' level. The functioning and relationship between these two sets of institutions is explored in more detail in the analysis of the main case studies.

take care to develop their own boundaries between what issues are truly within the domain of their 'scientific' activities and which lie in the political realm in a way that protects their own legitimacy. Chapter 4, which investigates the role of the Boards in more detail, suggests that creating such boundaries is often far from straightforward.

Furthermore, looking at the science of water quality from a critical social science perspective can be useful to highlight what problems are resolved effectively by science vis a vis those that are uncertain or context specific. Research on the environment and health is also pointing towards the inherent difficulties in deriving conclusive evidence of the human health effects associated with long term exposure to environmental hazards (Dunn *et al.*, 2008). This is particularly true in the case of impaired water quality since impacts on human health may arise from complex indirect mechanisms. Precisely how these mechanisms function is far less well understood than the human health impacts of direct exposure to poor water quality. For instance, heavy metals found in wastewater used for farm irrigation can remain in the soil and water for longer time periods. Using wastewater for irrigation can pose a risk not only to the farmers of food crops but also to consumers, through contaminated food crops purchased in local food markets (Marshall *et al.*, 2005). Wastewater irrigation is a practice that has become increasingly widespread in recent years even though the immediate and long term risks of such pollutants on human health are still not widely known (Shahalam *et al.*, 1998).

It is interesting to note that the problems with the use of expert knowledge have been pointed out by its critics in other fields such as the use of Environmental Impact Assessment (EIA) (Menon and Kohli, 2008) and the function of water regulatory authorities (Coelho, 2004, Dubash, 2008). The dominance of technical knowledge in the formulation of water quality priorities via environmental regulatory institutions such as the Board and State Boards has been somewhat taken for granted in these debates. As a result we still know very little about how formal policy priorities and the mandates of environmental regulatory institutions in India are set, or with what implications for the peri-urban. It also remains uncertain how much influence more 'bottom-up' research approaches (e.g. focusing more on the social dimensions of water quality) can have on expert-driven practices and associated interventions, considering that policies linked to water quality are shaped by powerful interest groups and hegemonic frameworks of knowledge production.

1.5. Motivation for the study: an alternative research approach

How water quality problems in peri-urban areas are manifested is the result of both conflicts of interests in resource allocation and the knowledge used to inform decision making. This fact has motivated this research to analyse in depth (i) the role of expert advisory systems, and (ii) how these interact with or come into conflict with other knowledge systems, and furthermore to link this analysis with insights from the political economy of water quality as it is presented in in the peri-urban fringe of Delhi. The study therefore poses the questions: *Why are problems associated with deteriorating water quality in peri-urban areas frequently neglected in expert-led policy processes? And furthermore, does this neglect carry specific implications for the poorest and most marginalised populations?* Up to now, research on peri-urban water quality has not succeeded in directly answering these questions. Peri-urban scholars have made some progress in recognising the tensions between local level realities and official practice. However the aim of this study has been to go beyond a place-based approach (Marshall *et al.*, 2009) focused on localised water quality problems in specific peri-urban areas, and to include the influence of expert advisors as well as the relationship of peri-urban water quality problems to mainstream policy thinking and practice.

The study builds upon the different theoretical perspectives discussed in Chapter 2. Insights from Science and Technology Studies have been useful for exploring empirically how technical knowledge mobilised by scientists working for the Board can legitimise certain knowledge claims around water quality in policy (Jasanoff, 1990). It has also been helpful for exploring further how ‘texts’ are used to put forward particular styles of argument for identifying, selecting and evaluating different courses of collective action (Hilgartner, 2000). The approach used here has been to reflect upon these expert driven framings of the problems, and their relevance to complex ecosystem dynamics witnessed in peri-urban areas and the water quality concerns of poorer user groups (Leach and Scoones, 2006) .

By building a better understanding of the use of expert knowledge, the study hopes to develop a deeper engagement with policy processes (Keeley and Scoones, 1999: 3), recognising that apart from science there are other less well recognised types of knowledge operating at the peri-urban scale. A policy process approach therefore shifts the attention from 'policy analysis to policy process analysis' (ibid: 3) and attempts to clarify connections between the processes of policy agenda setting and its implementation. It further perceives policy as involving *contestations of knowledge* between 'micro' and 'macro' spaces of decision making, involving scientists, local actor groups, water users and those exposed to problems of water quality (Barrett, 2004). The problem of unequal power relations between different stakeholders is explored, and the role of official discourses in promoting a particular framing of the problems (and their solutions) is addressed and continually reflected upon. With these considerations in mind, the next section summarises the key research questions that guide the thesis.

1.6. Research Questions

By studying the politics of the policy process and using a conceptual framework linking peri-urban dynamics to issues of knowledge, power and agency, the overarching research questions this dissertation seeks to address may be stated as follows:

Why are the problems associated with deteriorating water quality in peri-urban areas often neglected in expert-led policy processes? And as a consequence, what are the implications for peri-urban poor communities?

A set of more specific sub-questions is used to approach the overall research questions:

1. ***What are the roles of science and engineering practitioners (pollution control scientists, water engineers, hydrologists within the formal bureaucracy) and their expert knowledge in influencing policy interventions to address water quality problems?***
   - What are the main policy priorities (and inferred interventions) of scientists and engineers for addressing deteriorating water quality?
   - How do the disciplinary frameworks and discourses through which scientists operate indirectly shape the management of water quality in peri-urban areas?
   - How well are the water quality concerns of peri-urban poor communities represented in policy agenda-setting procedures?

2. ***How are formal policies translated and implemented by official actors and formal institutions operating in peri-urban areas?***
   - What synergies and contestations in framing policy priorities emerge between national and peri-urban policy actors?
   - What is the role of the everyday discourses and professional practices of officials working in peri-urban areas in shaping policy implementation?
   - What are the implications of current practice for the peri-urban poor?

1.7. Outline of chapters

Having outlined the context and the research questions which guide the thesis, the succeeding chapters are as follows:

Chapter 2 explores the body of literature upon which this research has been based. The research draws on different theoretical approaches and this is very much reflected in the literature reviewed for this study. A distinguishing feature of the approach used in this study is that insights are drawn from both policy studies and Science and Technology Studies (STS) in order to explain water quality policy processes.

Chapter 3 explains the methodology used for collection of empirical evidence. It elaborates on the conceptual framework, the choice of case studies and the fieldwork that was carried out in Delhi.

Chapter 4 is an empirical chapter where the case of the CPCB allows the study to move within the science-policy interface and describe the work of scientists operating within a regulatory organisation. The emphasis is largely on the discursive processes of knowledge production.

Chapter 5 is an attempt to look at the policy process from below. In the peri-urban district of Ghaziabad, poorer citizens are challenged on a daily basis by water quality problems. Specifically, the chapter describes not only the official view of the problems, but also the various ways in which water quality is entwined with poorer urban citizens' living conditions.

Chapter 6 serves two purposes. Firstly, it considers the empirical evidence gathered as part of the case studies. It also attempts to look ahead, and builds on the empirical evidence to suggest some features of an alternative approach to water quality management that is more adaptable to the complex water quality challenges presented in peri-urban areas.

Chapter 7 concludes by answering the research questions, by outlining the thesis' contributions to knowledge, and by discussing the limitations of the analysis and how critical knowledge gaps could be filled by future research in this field.

Chapter 2 Theoretical Departures of the Study

This chapter reviews a number of theoretical ideas and approaches that were considered in developing this thesis. Insights are drawn from diverse theoretical perspectives including actor orientated approaches to studying policy processes, and the role of discourse in shaping expert knowledge on water quality, as well as the science studies literature that provides specific insights on the role of scientific advisors working in regulatory and technical institutions. The motivation for reflecting on this diverse literature has been the fostering of a 'transdisciplinary' research involvement with water quality problems with a view to identifying coherences and to create bridges between the different viewpoints (Wickson *et al.*, 2006:1053).

2.1. From policy analysis to policy 'process' analysis

The first strand of literature that was considered is that concerning the study of policy, in terms of both how agendas are set, and also how they are implemented on the ground.

Traditionally, those interested in understanding the nature of policy have largely treated it as a linear phenomenon. Decisions are taken by those with responsibility for a given policy area (this often occurring at higher levels of the administration). These decisions take the form of statements or formal proposals on an issue, which in turn are executed by the bureaucracy (Pressman and Wildavsky, 1973, Hogwood and Gunn, 1984, Hill, 1993). From this perspective, it can be seen that expert knowledge (largely based on science) fairly easily acquires a privileged role in decision making, while frontline agents at the bottom of the policy chain are looked upon as passively receiving and carrying out policies usually dispensed from above (Aberbach, 1981). It is argued that the complexity of contemporary policy decisions requires the highly specialised and technical knowledge of trained scientists (Habermas, 1971, Wildavsky, 1979). With the source of knowledge to inform policy decisions being largely linked to the role of experts, it is often assumed that bureaucrats, administrators and politicians are responsible for implementation and agenda setting on the basis of complete knowledge of the problems and their solutions (Habermas, 1971, Fischer and Forester, 1993, Keeley and Scoones, 1999).

Proponents of this concept of policy perceive a rationalistic model of human behaviour based on a limited number of axioms, such as the maximisation of preferences or utility (Long, 1992:22). Much of the emphasis of this approach is on improving implementation procedures on the basis of more effective public management approaches, communication, incentives, sanctions and rewards in order to improve the execution of policies (Pressman and Wildavsky, 1973, Keeley and Scoones, 1999: 6). This linear view of policy is rooted in rational-choice theory and neo-classical economic models of human behaviour and response, embedded in modernist concepts of the interactions between people and society.

The rational choice policy model may be well placed for analysing easily monitored and controlled policy issues set within a well implemented administrative framework (Keeley and Scoones, 1999: 5). However, it is not helpful for understanding problems that are multi-dimensional and which involve the interaction of human and natural systems (Leach *et al.*, 2010). Water quality problems in peri-urban areas are often characterised by this type of complexity. On the one hand, they consist of multiple and sometimes overlapping policy areas linked to a broad set of issues, such as the management of domestic and industrial wastewater, ensuring the quality of drinking water or restricting river and groundwater pollution. On the other hand, water quality is also subject to opposing definitions and interpretations linked to diverse groups of actors both at the level of agenda setting and at the local level of implementation. Some of the actor networks that will be examined in the thesis later on include, for example, national-level expert policy advisors (scientists working within regulatory bodies) and also local-level official organisations, industrial associations, water users and those who are exposed to deteriorating water quality on a regular basis.

For a better understanding of the complex interrelations between different actor groups and across different scales, a different theorisation of policy is needed. More importantly, the interest lies in examining policy, not only in terms of the course of action that is proposed, but also in understanding why ‘inaction’ can often be a dominant policy approach. It is often the case that, although peri-urban areas offer several opportunities for promoting sustainability (e.g. linked to supporting informal arrangements for accessing water or recognising widespread agricultural practices), these areas are in general poorly understood by policy makers and often disregarded,

and as a consequence are defined by increasing marginalisation in formal policy and planning (Marshall *et al.*, 2009). A policy process approach encourages this study to take a step back and examine critically the knowledge reflected in polices, and also to examine why particular views for addressing impaired water quality are still powerful in spite of their apparent failures.

Central to the policy process framework proposed by Keeley and Scoones is the recognition that what different groups or categories of actors believe and do about a policy question is partly a reflection of their own interests (Keeley and Scoones, 2000). Furthermore, the influence of different interest groups is likely to play a role at each stage of the policy process, from agenda setting through to implementation (ibid). The trend of displacing the 'visual signs of poverty' (Fernandes, 2006: 22) and pollution to the peripheries observable in Indian cities, and the way this is driven by a new middle-class identity, suggest that worsening levels of water quality are not merely the outcome of poor environmental management practices. It suggests that they are linked to the particular alignment of the urban policy and environmental planning agenda with middle class interests, facilitated by the wider imperatives of India's neo-liberalisation. Policy implementation in the peri-urban context is also likely to be shaped by different interests. For instance, the fact that the peri-urban poor may lack access to infrastructure that could reduce their overall exposure to water pollution is linked to the fact that government agents operating in these spaces do not often see this as a priority. Further symptomatic of this is the 'decline in the ability of existing structures of representation to provide poorer social groups influence over policy' (Harriss, 2005:1041) that Harriss has observed in the context of Delhi. It is important to consider that because policy can, and often does, represent different interests it may not be executed in a pluralist way, but rather it can actually propagate the inequalities of exposure to water pollution observed in the peri-urban context.

Another important element concerning how interests shape the policy process, relates to the role of the expert advisory system which is examined in this thesis. The expert advice and policy positions adopted by scientists working for the Board and State Boards can be understood as being not only the result of 'science' alone, but also part of an exercise of defending the 'status quo' of environmental regulatory organisations in a context where environmental regulation is largely perceived as being ineffective. As a

consequence, policy attention is shifted to these water quality problems that are well defined and largely presented as 'solvable', or otherwise as existing 'outside' the control of the Board and State Boards. This has the effect of obscuring more political and power-laden issues, such as why poorer social groups tend to bear the heavier costs of ineffective regulation, or the underlying political reasons for the perpetuation of polluting practices in a peri-urban context.

Greater attention to politics and interests also shifts analytical attention away from a more instrumental-rationalist account of policy towards an approach that treats policy as more of a 'negotiative' exercise between different groups (Barrett, 2004:253). According to this understanding of policy, more attention is given to the ways in which decisions or specific policy outcomes are mediated by power, and how power shapes relationships between actors participating in the policy process (ibid.). This relates to a deeper engagement with two types of power dynamics perceived by the author as being influential in how water quality is currently managed in peri-urban areas. Firstly, the thesis discusses the ways in which power is embedded and reinforced in the dominant expert advisory system (Gaventa and Cornwall, 2006). This dimension of power is explored in detail in Chapter 4. Secondly, it gives emphasis to the power of governmental agents to shape policy implementation in a peri-urban setting (Barrett, 2004). Government agents (bureaucrats as well as scientists and engineers working for the bureaucracy) have varying degrees of power to negotiate or execute policies relevant to water quality management. It is important to understand the implications of their practices, in terms of whether they can facilitate or undermine equity and environmental sustainability in spaces that are often highly contested, such as the peri-urban.

In the context of the Indian water sector, scholars do indeed recognise that the production of such knowledge and research experience would be of 'strategic' value for the sector, because it focuses on the politics and power relations that can often stand in the way of improving equity and sustainability in water resource management (Mollinga, 2008:341). This understanding of policy also means that the overall analysis of water quality used in this thesis is not so much 'place-based' but instead attempts to integrate different contexts and locations, recognising the importance of actor groups operating both at micro as well as macro levels of decision making (Keeley and Scoones, 1999). In this study, the macro level is represented by the Board and the actor

networks that it entails, while the micro level is mostly represented by the actor networks identified within the Ghaziabad region of peri-urban Delhi. By bringing to the fore the mismatches and contradictions between the knowledge and perspectives that shape water quality priorities at these two different levels, the study hopes to propose features of a more integrated approach to the management of water quality. For example, suggestions for an alternative engagement with water quality are developed in Chapter 6 where the lessons learnt from the two empirical case studies are synthesised.

2.2. Relationship between knowledge, power and policy

With this multilevel perspective on policy in mind, this section introduces a separate body of literature that is relevant to this thesis and considers specifically how relations of power and knowledge between citizens, the experts and policy makers select which voices or perspectives become dominant in or are excluded from debates on policy.

A starting point for much of this work is the recognition that discourse is an important medium through which certain kinds of knowledge and perspectives may gain ascendance in policy. Through discursive processes certain claims or justifications can appear more legitimate while others can be side-lined or excluded (Long, 1992). The ability to ensure that certain justifications gain more power and 'stick' better in policy is therefore partly dependent on the strategic capabilities of the actors making the claims, but also on the content and how forcefully a particular 'discourse' is put to use (ibid). Hajer (1995) further elaborates that environmental discourses can be viewed as 'a specific ensemble of ideas, concepts and categorisations that are produced, reproduced and transformed into a particular set of practices that give meaning to both physical and social realities' (Hajer, 1995: 44). In his seminal work '*The Politics of Environmental Discourse*' (1995), he explains in detail the 'ecological modernisation' ideas which suggest, amongst other themes, that a much greater involvement of the private sector in the management of environmental problems has been largely facilitated by discursive processes (Hajer, 1995).

Several analysts have also argued that language in particular plays an important role in analysing how a given problem is determined and implemented in policy and practice (Apthorpe and Gasper, 1996, Grillo, 1997, Shore and Wright, 1997). In other words, although the notion of discourse can be treated as the overarching concept, it lends itself to different kinds of analyses and theorisations that stress the significance of the various linguistic strategies and terminologies deployed by different actors (Kaplan, 1993, Keeley and Scoones, 1999). The language strategies that mainly concern this study are often described as part of frame reflection (or framing effects) (Apthorpe and Gasper, 1996) and 'narratives' (or story lines) (Kaplan, 1993). Both framing and narrative, is drawn from the empirical analysis of the case studies and form an integral part of the thesis' approach to analysing discourse.

The idea of 'frame reflection' is used to analyse the process by which different frames (i.e. central organising ideas) are incorporated into policy positions that are expressed as a particular means of knowing, analysing, persuading and acting upon a particular situation (Rein and Schön, 1993). Framing further refers to the related 'assumptions, methodological variables, procedural attributes or interpretive issues' that different groups bring to a problem (Stirling *et al.*, 2007: 16). Critical reflection of how a 'system', 'condition' or 'method' is framed can reveal ways in which it is implemented or acted upon in policy practice (ibid). In some cases, such as in expert analytic approaches, a particular framing can be so powerful that it dominates the others.

Specifically, scientific and engineering perspectives tend to be very closely involved in the framing of the water resources management sector (a professional field that water quality is often considered to be part of) (Movik and Mehta, 2009). Engineering and hydrological authority in the organisation and planning of the water sector is partly attributed to the use of a variety of linguistic terms for defining the water system. A prominent example of this is the close connection between the engineering ethos of commensuration and the use of specific terminologies to define water system properties. Coelho's ethnographic study of engineers working for Chennai's water authority also demonstrates that 'pipes' and 'networks', 'infrastructural projects' and 'monitoring programmes' are often more than just language terms: they also encapsulate particular expressions of power employed to demarcate the authority of engineers in the management of the city's water and drainage network (Coelho, 2004:51).

Understanding how linguistic terms are used by powerful expert actors to frame water quality is of further interest to this study because it illustrates how boundaries are drawn around problems according to particular techno-scientific ideals or technical configurations (Effluent standards, monitoring frameworks and water sampling protocols are all often involved in the framing). In the light of this reasoning, engagement with the effects of framing can facilitate a better understanding of the discursive approaches available to actors in order to effectively 'rule in' certain ways of talking about a topic (in this case the topic is water quality), defining an acceptable way to talk, write or conduct oneself, whilst at the same time 'ruling out' or restricting other ways of talking or constructing knowledge in relation to the same (Hall, 2001: 72). Why such discursive strategies have been so successful despite their limitations is partly attributable to the fact that water quality is linked culturally with embedded notions about 'faeces', 'filth' and 'dirtiness', all of which are still largely treated as taboo topics by policy makers and politicians (Black and Fawcett, 2008: 72), and by default are delegated to scientists for finding policy solutions.

From a somewhat different viewpoint, a study of framings can also be consolidated to explain diversity across the different positions. In the context of the '*STEPS Rethinking Regulation'* project[6], which looked at seed and drug regulation, systems are likely to be 'explicitly or implicitly understood or framed by users, regulators and legislators in very different ways' (Van Zwanenberg *et al.*, 2008: 41). Similarly, although expert actors tend to put forward powerful framings as discussed in the previous paragraph, we can also expect the framing of 'water quality' to vary between different groups of actors, and especially as it moves across scales and different contexts. The undertaking of 'regulating' water quality is likely to be framed in a very different way by national experts working from a pollution control standpoint than by the water authorities operating in the peri-urban context, whose intention is to provide a supply of drinking water to the settlements. Another point of divergence in framing may also emerge between the more formalised 'scientific' framings of water quality and the less understood 'experience based' perspectives of marginalised citizens. So the overriding

[6] The STEPS (*Social, Technological and Environmental Pathways to Sustainability*) Centre is an interdisciplinary global research and policy engagement hub, funded by the ESRC. It brings together development studies with science and technology studies in order to research health, agriculture and water. It is based at the Institute of Development Studies and SPRU Science and Technology Policy Research in the UK: official website, http://www.steps-centre.org.

purpose of studying the divergent framings is to understand in more detail the extent to which these can 'capture, understand, and thus potentially intervene in the realities of poorer communities' (ibid: 41).

An alternative approach where discourses can be understood in relation to power is through the identification of stories or 'narratives' that participants are prepared to tell about a given policy situation (Fischer and Forester, 1993, Kaplan, 1993, Keeley and Scoones, 1999). By identifying a set of policy narratives, the aim is to clarify how boundaries are drawn around water quality problems, and to identify what is included in or excluded from powerful knowledge systems. In India, the scientific-administrative vision of the river is shaped by a narrative which assumes that rivers will always adapt to continued growth in human settlements and consumptive market demands (Alley, 2002:238). This narrative however, is currently subject to much opposition. There is empirical evidence that suggests important rivers are in fact experiencing rapid degradation due to pollution, and are increasingly less able to sustain new pressures and demands (Sharma and Kansal, 2011).

Similarly, much knowledge and information circulated within formal organisations can be explained through narrative processes (Gabriel, 2004: 73). Organisational narrative processes in particular are examined in order to understand how narratives expressed by expert advisors become dominant in characterising water quality problems. In Chapter 4 of this thesis, key narratives through which water quality regulation is understood by expert advisors are explored. This analysis demonstrates that the type of regulatory priorities proposed by expert advisors, and the expectations around the enforcement of water pollution norms and guidelines in local areas, are formed not just by powerful assumptions but also by different styles of rhetoric. In cities like Delhi, the inability of current technological and administrative systems to control river pollution effectively is often attributed by public officials and scientists to a dominant narrative of 'implementation failure'. This has led to a predominant emphasis on a 'project-based' approach for dealing with complex river systems, involving vast financial investments

targeting the implementation of various river-cleaning projects[7], but this approach tends to obscure not only the importance of more profound political processes that influence implementation procedures but also the inherent limitations associated with how river pollution is defined more broadly in policy processes (Alley, 2002).

By elucidating how these concerns are formulated in policy practice, the aim has been not so much to come up with alternative prescriptions for policy, but more importantly to shed light on the specific reasoning strategies that operate in the background behind established policy goals and preferences. Narratives further provide an entry point for challenging 'deeper truths' (Gabriel, 2004: 74) about a particular policy situation or organisational logic which are often assimilated without questioning by those that are involved directly in the formulation of policies.

2.3. Scientific authority in the policy process

This section turns to the literature on scientific expertise and its relationship with policy. On the one hand, in India today, formal policies to address water quality are guided by powerful water resource management bureaucracies, including water ministries as well as water and sewage engineering agencies at city level. On the other hand, significant powers in terms of water quality management are placed with a separate group of institutions focusing on environmental pollution regulation. Because of the federal structure of governance in India, the latter function in two tiers, the central government level and 'state' level. These are what will concern this thesis the most in the following chapters. Such sectors are traditionally directed by technical experts operating within a limited range of specialisations, including pollution control and water technology specialists, hydrologists, river engineers, and chemists.

[7] Delhi authorities have invested in an ambitious multi-million dollar technological project to intercept domestic wastewater entering the Yamuna river (The Hindu, 2010). Other large-scale initiatives are also promoted by global institutions such as the World Bank sanctioning 1$ billion credit and loan for cleaning the river Ganges. The criticisms surrounding the implementation of these projects are escalating, primarily because of the largely technocratic approach adopted to address core water pollution issues presented in the Indian context today (CSE, 2007).

The role of this particular group of actors is fundamental to understanding how experts influence policy approaches for managing water quality. Bringing in perspectives from the academic debate on the function of science (or science studies) is therefore relevant and useful because it examines how different relationships between scientists and governments are formed and sustained more thoroughly than the policy studies literature discussed earlier. However, as this is a very extensive body of literature covering a long time span and including many sub-fields and disciplines, the purpose here is not to encompass all the different aspects but to present some of the most relevant themes, based on authors who have examined the function of science both in Indian as well as Western contexts.

The basis for much of the work on the sociology of science is to highlight how science, like other domains of authority (such as religion or law), also needs to be examined as a socially constructed phenomenon (Latour, 1987). This means that even though scientific knowledge is often presented as 'objective' and 'rational', in reality the production of 'scientific claims' has associated social and policy commitments (Irwin and Wynne, 1996). A widely accepted line of explanation emanating from the Mertonian school stresses the shared norms that foster cohesiveness in science, even though its practitioners may enter from divergent geographic, cultural or linguistic backgrounds (Merton, 1973). Other scholars have called attention to the elitist process of entry into the scientific community, which is encouraged by invisible colleges[8], academic research networks and 'gatekeepers' comprising senior academic colleagues and lead editors of scientific journals (Crane, 1967, 1989).

As critics of technocracy have further pointed out, these processes have in turn legitimised science as an authoritative body of knowledge, and have facilitated the perception amongst decision makers and policy makers that science is capable of providing accurate and objective answers to what should be achieved in matters of policy (Price, 1965, Habermas, 1971, Wildavsky, 1979). Based on these assumptions,

[8] The term has been used to describe a closed network of individuals that share similar core beliefs (mainly technically driven) about a subject area or policy problem. An early use of the term was to describe members of the Royal Society in London and to emphasise that they were geographically close together and shared common scientific interests (Lievrouw, 1989:618). A related contemporary use of the term can also be traced to the concept of 'epistemic communities' to describe networks of expert actors operating at the international level who can have a powerful role in shaping dominant policy positions (Haas, 1992).

the state in post-colonial societies has become very supportive of western scientific models in development projects and modernisation schemes (Sachs, 1992, Escobar, 1995, Scott, 1998). In the Indian context especially, Jawaharlal Nehru's conception of a 'science-led' Indian modernity formed the basis for science to become part of the modern state, facilitated by the foundation of the Council for Scientific and Industrial Research (CSIR) and technical universities such as the Indian Institutes of Technology (IIT's), and also the nationwide expansion of large-scale engineering projects (such as the 'Dam Era'), thus establishing the role of scientific experts in several domains of government functioning and policy making (Visvanathan, 1985, Kumar, 1995, Prakash, 1999).

Partly due to the introduction of engineering approaches in formal policy and planning, natural resource control, through maximising the utilisation and productivity of nature, became the new policy imperative (Scott, 1998). In specific sectors such as irrigation, water became the focus of engineering efforts to counteract its natural tendency to run to 'waste', thereby bringing large new areas of land under irrigation and improving the distribution of water to individual users (Gilmartin, 2003). The spread of powerful expert-driven views around resource control and the commodification of water empowered the state in colonial societies to break through the power of village communities and extend a technical system of irrigation into villages that were previously seen as development failures (ibid).

A series of development schemes taking place in India today affirms the continued hegemony of some of these engineering doctrines in post-colonial societies. For example in the 1950s and 1960s the premises underlying the construction of large dams can be seen to be based on the same rational and positivist notion of western science that legitimises state control over nature and rivers (Mehta, 1998). Furthermore, more recent policy propositions, such as the 'national river linking project' involving the large-scale transfer of water (using large reservoirs and barrages) across separate basins and over long distances, confirm the prevailing prestige of established scientific disciplines (hydrology and river engineering) in the management and planning of the water sector (IWMI, 2008).

The prestige and authority granted to scientific expertise in addressing water quality can be traced back in history to Europe's early modernity. In many towns and cities including London and Paris, the emergence of the 'bacteriological city'[9] ideology in 19th century Europe was set in motion by scientists, and this brought about a set of drastic state reforms for centralised public water and sanitation (Gandy, 2006). This was a period of profound transformation in people's attitudes to and perceptions of the very notions of water and waste. The rapidly growing popularity of the newly established disciplines of microbiology and sanitary engineering meant that novel hygiene standards were quickly adopted by urban citizens and established traditional customs associated with water were soon forgotten (Goubert, 1989). People who had previously relied on their sensory perceptions (such as taste, colour and appearance) of water and its quality were becoming familiar with the technical logic of 'monitoring', 'distribution', and 'drainage' based on the newly acquired scientific knowledge (ibid: 32).

Specifically, concerns about the 'contamination' of drinking water quality were often the precursor for scientists to promote a broad range of institutionalised practices (Johnson, 2006). The harm caused to human health by typhoid and cholera bacteria meant that water contamination had to be contained by the vigorous monitoring and purification of drinking water sources (e.g. lakes or underground aquifers), or alternatively by installing an alternative 'pipe' system for the supply of 'pure' water (Goubert, 1989:109). Hence, from being merely a field of scientific enquiry, the pursuit of pure water in early modern Europe quickly became a large-scale political and administrative priority. With expert assessments of water quality being entrusted to scientists, health practitioners and technical experts were recruited at various levels within the administration to assist the bureaucracy with the accumulation and dissemination of water quality information.

[9] The term has been employed in order to suggest an organic conception of the modern metropolis that viewed human faeces not only as a matter of unpleasantness but also as a source of danger to public health (Gandy, 2006). This was a core principle for introducing sanitary reforms in urban areas, in that public health fundamentally depended on water moving through the whole urban body, thus eliminating disease.

Today, with experts extending their power and authority beyond the traditional boundaries of urban and sanitary reform, water quality has become a subject with new meanings and interpretations. More importantly, early modernity water quality concerns were focused around the potability of water in cities and towns, whereas attention has now shifted towards environmental protection, river conservation and pollution control concerns (Alley, 2002). This has contributed to the creation of new forms of hegemonic discourses and practices around water quality which will be explored in subsequent chapters. The doctrine of 'assimilative capacity' has formed a basis for viewing rivers not as ecosystems but rather as waste management commodities with the capacity to recover and dilute urban waste (Keeling, 2005). Furthermore, water quality has also become associated with new metrologies and monitoring strategies such as Biological Oxygen Demand (BOD) which helps assess the level of pollution a river system can sustain (Keeling, 2005). (The use of the BOD is explored again in section 4.4.2).

This shift of attention around environmental water quality has encouraged the designing of new institutional structures and has promoted legislative changes that extend beyond public health concerns (particularly the contamination of potable water sources) to include a core environmental perspective as well. In India particularly, the fact that water quality became associated with the environmental degradation of important national river systems was a precursor for the inception of the Board (the subject of Chapter 4) in the 1970s and the founding of the Water (Pollution and Prevention) Act (Gazette of India, 1974).

Although the different measures that have been adopted over time for managing water quality are still greatly celebrated within the wider scientific community, in many regions of the Global South they have not produced the same positive outcomes observed in Western contexts. More importantly, the eagerness of policy makers to provide 'quick fixes' for complex, technical, environmental and social dilemmas around water and sanitation has, in many instances, contributed to segregation between the European elite and indigenous communities and also the changing by force of traditional practices, behaviours and cultural relationships with water (Prashad, 2001, Sharan, 2002, Broich, 2007). All this has brought about the added cost of widening disparities between the rich and the poor, particularly in terms of access to clean water and sanitation (Gandy, 2006, 2008). These inequalities are also highly apparent in peri-

urban environments. Chapter 5 in particular demonstrates that, at present, in peri-urban Delhi a clear demarcation between the poorer and the more affluent groups is sustained by the formal system for providing sanitary and water technologies. The way water and sanitation technologies are distributed among different populations determines the extent of their exposure to deteriorating water quality. Yet another unintended consequence of the granting of exclusivity to technical knowledge is the underestimation of the importance of experience-based knowledge and perceptions regarding water quality (see Black and Fawcett 2008; UNDP 2006). Also discussed in more detail in Chapter 5 are citizens' assessments of water quality. It demonstrates that a better awareness of citizen-based perspectives has repercussions for improving the living conditions of the poor. At present, however, these are not granted the same focused attention accorded to science and engineering, while policy makers in developing countries continue to draw upon technocratic approaches for proposing a diverse array of water reforms (Mehta *et al.*, 2007).

2.4. Expert knowledge systems and policy practice

As the previous section has attempted to illustrate, historical processes have played an important role in establishing a particular form of expert knowledge for addressing water quality. However, in order to study science as a contemporary phenomenon, other scholars have also argued in favour of a more systematic examination of scientific practices and discussed how these can be implicated in experts' efforts to maintain credibility, influence and institutional authority (Wynne, 1992, Hilgartner, 2000). This is certainly more relevant when scientists' work relates to policy because the need to safeguard themselves against charges of inaccuracy becomes an institutional imperative (Jasanoff, 1987).

However, when the questions posed to scientists cannot necessarily be answered by the prevailing technical knowledge, upholding credibility becomes increasingly more difficult. In the case of water quality, scientists were in the past asked to deliver solutions to clearly bounded policy problems such as the potability of drinking water or the disposal of raw sewage (Goubert, 1989). Now concerns have shifted from these more discrete policy domains to potentially more complex and cross-sectoral water quality problems, such as the effect of specific heavy metals and toxins found in the

water on human health and wellbeing, regional food systems and river ecology. The limitations of science to produce accurate solutions to emerging environmental concerns becomes more problematic in the context of 'regulatory science'[10] (Weinberg, 1985: 68), when the regulator is expected by law to regulate (and provide definitive answers to) complex environment concerns, but science has often proved inadequate for providing reliable answers. From the point of view of the science practitioner, this creates a series of unresolved tensions, including the inability to defend as 'credible' a range of expert driven solutions, as well as the difficulty of developing effective communication with public stakeholders (Irwin and Wynne, 1996).

Social studies of science, by taking a more critical stand on the practice and diffusion of scientific knowledge, attempt to shed light on how scientists resolve these dilemmas. The technical and the social aspects of scientific work are no longer perceived as separate worlds. Instead, the technical aspects are analysed in conjunction with the performative aspects of scientific activity, thereby highlighting the social practice and culture of scientists and engineers (Pickering, 1992). The scientist is no longer looked upon just as a technical worker, but instead as a 'heterogeneous engineer', whose role is to engage in political, economic, and sociological activities (Law, 1987: 10). Out of this framework a series of empirical studies of contemporary scientific developments and scientific controversies has emerged, illustrating the socially constructed nature of scientific knowledge (Bloor, 1976, Jasanoff, 1990, Barnes *et al.*, 1996). The intention of these studies is to reveal that simple 'facts' cannot be accepted by virtue of their truth alone, and that their development is in fact subject to a sociological process (Callon and Latour, 1992, Barnes *et al.*, 1996).

This body of literature is particularly relevant for developing a better understanding of the role of environmental regulatory institutions such as the Board, discussed in Chapter 4. It focuses on the individual scientists working within the institution, by examining the practical application and discursive representation of various routine procedures, measurements and water quality monitoring programmes that they put into practice. Many of these have been modelled on the basis of Western knowledge systems and institutional plans inspired by institutions such as the *U.S. Environmental Protection Agency* (USEPA) (Lele *et al.*, 2010). But because of the relative acceptance of scientific

[10] 'Regulatory science' is defined in Weinberg (1985) as science used in environmental regulation.

routines related to water quality management in Western contexts, they have not been subjected to much scholarly attention nor indeed has their viability in the context of developing countries been adequately examined. In other words, the nature of the 'expert knowledge systems' (that pertain to water quality management) largely remain 'black boxed' (Knorr Cetina, 1999: 7). As well as explaining the specific constructions of water quality adopted by the scientists, using water quality as an entry point encourages further questions on the interweaving of expert knowledge with society and public policy (Jasanoff, 1987, 1990, Shackley and Wynne, 1995). This is an area of research that has been addressed by previous social studies of science in India[11] but not specifically in relation to the particular implications of regulatory and scientific decision-making for the livelihoods of poorer populations and local environments that are exemplified by peri-urban areas.

Water quality also provides an interesting study focus for examining expert scientific practice because it encourages the research to traverse across different contexts that are not normally included in social studies of science. For instance, scholars who have observed scientists in their workplace have, in most circumstances, tended to select the 'laboratory' as the main site of inquiry (Latour, 1987, Pickering, 1992, Knorr Cetina, 1999). In contrast, this study examines scientific practice not just in regulatory institutions, but also in peri-urban pollution control agencies and water and health authorities. In these semi-bureaucratic environments, scientific practice is more likely to be informed by a different set of experiences and work pressures. Scientists working in the laboratory are obliged to produce 'innovative ideas' and 'experiments' (Knorr Cetina, 1999) while scientists whose work is closely linked to policy are subordinate to institutional pressures that critically influence their professional attitude towards issues of proof and evidence (Nelkin, 1975, Renn, 1995). Furthermore, political demands for speed in gathering and assessing evidence imposed by public stakeholders and political interest groups (such as the media, the courts and environmental NGOs) can result in narrowly defined policy recommendations and assessments of risk situations (Jasanoff, 1990).

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[11] See for instance (Visvanathan, 1985) *Organising for Science: the making of an industrial research laboratory.*

2.5. Responding to risk, uncertainty and ignorance

Within risk research, a range of theoretical and empirical studies have also illustrated why focusing solely on expert assessments of risk can be particularly problematic. The German sociologist Ulrich Beck was the first to use the term 'risk society' to describe how responses to risk have shifted with the evolution of modern societies (Beck, 1992: 92). According to Beck, during the early stages of industrial development, risk was primarily perceived as the product of natural hazards, such as floods and epidemics. During this period scientific and technological progress is rarely brought into question, and neither are the experts and government representatives that guide the management of these risks. Risks are further perceived as quantifiable and easily controlled, solely on the basis of available expert analytic methods and approaches.

During late modernity, the period that Beck describes as 'reflexive modernisation', science and technological progress become increasingly more important in the 'creation' of risks (Beck, 1992: 93). Another prominent sociologist from the United Kingdom, Anthony Giddens, expanded upon Beck's 'risk society' to suggest that risks presented during reflexive modernisation are, in essence, 'manufactured risks', and therefore deeply embedded in the process of industrial, technological and scientific development (Giddens, 1999: 4). Environmental risks in particular are intimately linked with both Beck's and Gidden's conceptualisation of the risk society, whereby risks related to chemical pollution, toxic wastes, nuclear energy, and biotechnology are risks that industrial society has generated and are typically marked by high levels of uncertainty in terms of both their long term side-effects and the types of options available for their effective management (Dryzek, 1997:149).

Under these conditions, dealing with risk on the basis of science-based methodologies alone can be acutely problematic. Particularly in the context of environmental risk systems, as Wynne argues, 'the very considerable amount of scientific work which has gone into the modelling of risk cannot be taken as reassurance that even the main dimensions of environmental harm from human activities have been fully comprehended' (Wynne, 1992:113), not least because there are a range of uncertainties and sources of incomplete knowledge involved in the definition and subsequent evaluation of environmental harm (Wynne, 1992, Stirling *et al.*, 2007). Brian Wynne

further illustrates his point by reference to how risk from radiation was evaluated in the aftermath of the Chernobyl nuclear accident (Wynne, 1992). In May 1986, a radioactive cloud passed over the UK. Despite reassurances from the scientists that there would be no lasting effects of the radioactive cloud, elevated levels of radiocaesium (the radioactive element which was likely to pose environmental harm) were observed in the soil and for a long time after the accident. As it turns out, scientists were wrong in their predictions of how radiocaesium would behave after it entered the soil (ibid:113). However, at the time when the scientific investigations were carried out, the uncertainties involved in the measurement and evaluation of possible risks from radiocaesium were grossly understated, damaging as a result the credibility of the scientists and institutions involved.

The regulation of risks to human health from water pollution can also be subject to uncertainty even though risks are typically viewed as being 'determinate' and easily 'quantifiable' (Stirling *et al.*, 2007: 59). Risk from water pollution is perceived as being, in principle, parameterisable through the development of standards for toxic substances and pollutants, when in practice the management of water quality on the basis of standards can be seriously limited, either because the standards are not implemented properly[12] or because specific toxic substances that have an impact in local contexts are omitted from the evaluation of possible risks (Ziem and Castleman, 2000). In addition, there can be divergent expert interpretations of what are deemed 'acceptable' pollution thresholds. The standard setting process can thus be viewed very differently by health professionals, community organisations and representatives of industries as well as across different levels[13] (Dunn *et al.*, 2008). Perception and admission of uncertainty can also vary depending on the position of the actor involved in the production of knowledge (MacKenzie, 1990). Scientists that are institutionally committed to the knowledge being produced may crucially undermine uncertainty, offering instead a

[12] This can often be the case in peri-urban contexts exhibiting high levels of environmental pollution.
[13] The comparison of the case studies later demonstrates that scientific advisors working for the Board at the national level assume implementation of water quality standards to be vigorous in peri-urban areas. By contrast, fieldwork observations in the Ghaziabad region demonstrate that standards for industrial and domestic water are, in reality, weakly enforced.

picture of 'misplaced concreteness'[14] (Stirling, 2011)(85) around the process of risk assessment (MacKenzie, 1990, Keeley and Scoones, 1999).

'Ambiguity' and 'ignorance' are also characteristic properties of any risk appraisal (Stirling *et al.*, 2007). Under the heading of ambiguity, disagreements may exist between different actors over 'selection, prioritisation and measurement' across a different range of risk situations (Stirling *et al.*, 2007)(10). The Board for instance has its own framing of what are the right questions to pose in in the context of water quality regulation. Questions such as 'where to monitor water pollution?' or 'what type of pollution sources pose greater environmental harm?' are therefore posed quite early on in the water quality assessment process (see also section 6.1.1). However, answers to these questions are often highly contested across different specialisms, disciplines and social groups. For instance, the issue of river pollution may be identified as an important source of risk from the perspective of pollution scientists, but from the perspective of water engineers, drinking water quality appears much more central to how risk is perceived.

The problem of ignorance is by far the most elusive hazard in risk assessments because it involves the position where 'we don't know what we don't know' (Wynne, 1992:114). It differs from ambiguity in that the parameters are not just contestable, but at least partly unknown (Stirling *et al.*, 2007). For instance, whether problems of water quality are likely to be exacerbated in the near future is conditioned by a range of ecological, economic and social factors of which knowledge can be either lacking or highly fragmented. Climate change is likely to accentuate certain problems due to changes in rainfall, temperature and the incidence of floods (Petit, 2005). However, there are other key drivers of change such as urbanisation, industrialisation, and wider socio-political and economic transformations (particularly in developing countries) that are likely to impact on water quality as well. Under such circumstances, bringing ambiguity and ignorance into the evaluation of risk requires not only intense and open examination of the existing evidence sources and their competing interpretations; it further requires a deeper understanding and recognition of the types of incomplete knowledge surrounding the problems that are being assessed.

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[14] I elaborate further on this concept in relation to the way Board members solicit expert advice on water quality in section 6.1.2.

Largely due to the prominence of expert science in the evaluation of risk, one important source of knowledge that has so far been given far less attention is that of citizens. A discussion of citizen knowledge in the risk literature has come into existence primarily as a reaction to the growing mistrust amongst citizens in techno-scientific evaluations, and often following catastrophic failures of risk regulation (Freudenburg, 2003). In the 1970s at Love Canal, at Three Mile Island, and at Wolburn, Massachusetts (to name a few prominent cases) citizens conducted their own assessments to better understand the risks associated with their own exposure to toxics, in response to the discovery of the presence of toxic waste (Levine, 1982 , Brown and Mikkelsen, 1990). Through a process that Brown (1992) has coined as 'popular epidemiology'[15] they exercised their own political power in risk communication, and used their own exposure assessments to challenge expert opinion, the state and local authorities (cf. Fisher, 1993). Although it is important to avoid reifying categories such as 'local', 'traditional' or 'lay' knowledge when referring to citizen knowledge as if these were invariably monolithic entities (Agrawal, 1995, Wynne, 1996), a number of published papers have highlighted that better recognition of citizens' own accounts when dealing with environmental risk systems can be helpful in broadening risk appraisal and taking it beyond the confines of expert science (cf. Funtowicz, 1993, Irwin and Wynne, 1996, Leach *et al.*, 2005).

An important point of divergence of citizen knowledge from expert knowledge is that 'it does not owe its origin, testing, and degree of verification, truth, status or currency to distinctive…professional techniques, but rather to common sense, casual empiricism, or thoughtful speculation and analysis' (Lindblom and Cohen, 1979: 12). As a consequence, experts and lay people can often perceive risk in very different ways and employ different kinds of rationality for deriving risk estimates (Tesh, 1999). For instance, in a study conducted by Slovic, Fischoff and Lichtenstain to understand ordinary people's perception of risk from technological hazards (such as nuclear power and pesticides), it was found that values and belief systems had a much more prominent role in making judgments about risk than in the case of professional risk assessments (Slovic *et al.*, 1980). Citizens were observed to take into account issues like fairness and

[15] Brown (1999) defines popular epidemiology as the process whereby lay citizens 'gather scientific information and other information, and also direct and marshal the knowledge and resources of experts in order to understand the epidemiology of disease' (ibid: 269).

equity in how they perceived risk, while they also considered community cohesion and the impact of technological hazards on their personal lives and future generations (ibid).

Given the problems of risk evaluation on the basis of reductive-aggregative methods discussed earlier, citizens' accounts can therefore allow for greater 'interpretative flexibility' in the evaluation of risk, and encourage a better engagement with less salient properties of risk assessment, namely those of uncertainty, ambiguity and ignorance (Stirling, 2011: 85). In the context of peri-urban citizens' exposure to risks from worsening levels of water quality, it is explored, for instance, how citizen knowledge comes in part from actual sights, smells and tastes along with the tactile and emotional experiences encountered in everyday life (cf. Corburn, 2004). This is in contrast to the professional knowledge of scientists which is based on technical criteria of risk evaluation (Karpouzoglou and Zimmer, 2012).

2.6. 'Interface' situations between multiple actor groups

Another useful way in which the interaction of different types of knowledge systems can be further conceptualised is by examining those instances when actors from different social and professional positions interact in 'interface situations' (Keeley and Scoones, 1999: 20). It is during these instances that social actors negotiate, adapt and sometimes clash with each other's 'life worlds' (Long and Long, 1992). In contrast to examinations of knowledge outlined in previous sections, the main defining feature in this literature is that knowledge production arising out of 'interface situations' should not always be equated to some set of 'professional' or 'scientific' ideas and procedures. It is also a part of 'everyday' forms of knowledge that are tied to social categories, beliefs and practices, all contributing to the sustenance of more practical forms of knowledge (Arce and Long, 1992:211). Furthermore, processes and outcomes of such practical forms of knowledge are here too arbitrated by sources of power, authority and legitimising processes in a similar way to professionalised knowledge (ibid:214). Through involvement with 'interface situations', the aim is to explore the key synergies and interactions, but also conflicts that exist between the various actor groups involved in the policy process.

One such interface situation that the thesis explores in more detail is the interaction between pollution scientists working at the national level and enforcement officials

operating in a local context. This is an important interface because it highlights the types of contrasts that emerge when the functioning of national expert advisors are compared to that of officials working within peri-urban areas. Insights from social studies of pollution draw attention, for example, to the fact that the role of enforcement officials can provide unique insights into the realities of non-compliance and help to 'zoom-in' on the primary causes of a range of implementation failures (Hawkins, 1984, Fineman, 2000, Lo *et al.*, 2006:390). More importantly, for expert advisors technical 'know-how' is much more central to their everyday activities, whereas officials in peri-urban areas are often driven by more pragmatic motives geared towards resolving practical problems (Lipsky, 1983). The knowledge and perspectives of officials in peri-urban areas are explored in detail in Chapter 5.

In particular, the more practice-based learning that officials bring to their involvement with water quality issues draws attention to actor networks that are not well recognised by expert advisors at the level of policy formulation. In effect, it draws attention to power-laden interactions taking place between official agencies and other institutions. These include, for example, the influence of industrial representatives on the performance of pollution control institutions operating in the peri-urban.

Another interface of interest to this study is one that emerges between pollution control officials (and other official practitioners) and everyday citizens. Here the interest is related to that described previously since it explores the role of practical knowledge in shaping interface situations. However, the emphasis is on identifying ways in which policy agents may exercise various 'labelling' strategies, and as a consequence may often respond in highly stereotyped ways to the particular needs of their clients (Lipsky, 1983). This is a line of inquiry that may be more imperative in policy situations that are often perceived to be resolved purely on the basis of technical or managerial knowledge. For example, even in a highly technical field such as urban water supply, engineers can categorise their clients on the basis not only of technical considerations but of normative judgments such as the social status, geography and water needs of different citizens (Coelho, 2004). Such categorisation patterns in turn significantly influence how engineers prioritise their time and workload for servicing different groups of citizens. It is more common for citizen categorisation patterns to favour to a large extent the urban elite over poorer populations.

One of the implications of examining how experts employ categorisation strategies is that they provide deeper insights into how the poor in particular are positioned in the implementation of formal plans and policy programmes in peri-urban areas. As Coelho noticed in her study, the main reasons why poorer citizens were often inadequately served by Chennai's Metrowater engineers was because they were characterised as 'disorderly', 'demanding', representing an 'over-politicised' public, and typically unwilling to pay for public services (Coelho, 2004:215). Particularly in the Indian context, the power of labelling can be traced back to the role of the judiciary who view urban poor settlements as 'illegal' encroachments on public land (Ramanathan, 2006). This reframing of poor settlements as being 'illegal' has furthered a major programme of slum demolitions and clearances that act against the constitutional right of citizens to live and work within expanding metropolises (ibid). As a result of this new discursive representation of urban poor settlements, they are identified as 'nuisances', with labelling terms such as 'infesting', 'mushrooming' and 'bursting' being used to evoke Malthusian fears that mere presence of the poor in the cities is a threat to the welfare of society as a whole (Ghertner, 2008: 64). Laying emphasis on labelling is therefore essential for identifying in discursive terms the powerful images and stereotypical characterisations that officials may frequently draw upon when considering the poorer citizens' specific needs and exposure to poor water quality.

2.7. Conclusion

As stated in the introduction to this chapter, the aim here has been to relate emerging water quality challenges (particularly those affecting peri-urban environments) to different epistemologies and theoretical positions. Because the debate on water quality is still often dictated by scientific perspectives, it was helpful to draw insights from both policy studies as well as science studies. This proved to be of value for understanding, not only how a technical approach to water quality emerged in the first place, but also of how it still manages to appeal to decision makers in spite of its inherent failures. Both policy and science studies retain a long tradition and involve many sub-disciplines. The aim of this chapter was not to provide an exhaustive account of these literatures but to demonstrate how these literatures, and the links between them, can be valuable for understanding the types of knowledge and actors that are steering the appraisal of water quality priorities in peri-urban areas at this point in time.

In examining the functioning of expert knowledge systems, a historical perspective is useful for demonstrating how certain interpretations of water quality have managed to gain authority by the forming of a close relationship between scientists and state bureaucracies. Although science is viewed as a tool for providing legitimacy to policy decisions, it also has its limitations. To be more specific, it can operate in a way that undermines uncertainty (e.g. in dealing with selected risks of limited pollutants to environment and health), and can also restrict the level of involvement of public stakeholders in decision-making. Through the use of case studies, the thesis will try to demonstrate that these ideas also affect the way problems of impaired water quality are addressed. Also it hopes to demonstrate that water quality can be a useful entry point for exploring the interaction between science and policy in environmental regulatory institutions in India, an issue that so far has received less focused attention from science studies scholars.

The fact remains that the science studies literature focuses a great deal more on the scientists' views and much less so on the points of view of other actor groups. This is why scholarly accounts of the policy process are valuable for the integration in research of potential synergies and contestations that may arise in the framing of water quality across levels and by different actors. What sets a policy process framework apart from traditional analyses of policy is that it addresses both policy agenda setting and implementation procedures. As a consequence, it provides more scope for peri-urban realities concerning impaired water quality to be compared with the prevailing opinions and views of expert advisors. Furthermore, it fosters a better understanding of alternative accounts of the policy process emanating from civil society, poorer groups affected by poor water quality and officials who work in peri-urban areas, by drawing upon narrative processes and framing effects, as well as 'interface' situations which emerge between the different actors.

Chapter 3 Research Design and Methodology

Building on the theoretical perspectives discussed in Chapter 2, the methodology used treats social actors not simply as separate social categories or passive recipients of interventions, but rather as active participants who in their own capacity (and operating at different levels) are in a position to process information, plan strategies and produce knowledge using a variety of arguments (Long, 1992, Hajer, 1995, Keeley and Scoones, 1999, Mehta *et al.*, 2007). Firstly, the main categories of actors that the research has attempted to capture are those in positions at the national level, and it draws from the influence of expert advisors on framing policies related to water quality. Secondly, it captures those groups of actors operating at the local level in a peri-urban district of Delhi, and introduces empirical insights into the translation and implementation of formal policies, directly from peri-urban areas.

A central feature of the research, as explained in Chapter 2, is the recognition of 'discourse' as an important medium in order for certain kinds of knowledge and perspectives to gain influence in policy. More importantly, in the description of the case studies, discourses attached to the different actors have been identified in order to explain the work, the social relations and routines that are often drawn upon for legitimising policy decisions. As an overall approach, it attempts to question the 'status quo' of expert advisors who have been granted the scope to introduce their insights into decision-making somewhat unrestrictedly. In particular, a discursive frame accommodates the influence of power as an underlying cause for failure of expert advisory systems to respond to the inherent complexities of the peri-urban.

The centrality of discourse also implies that the methodological tools used here rely heavily on the interpretation of subjective data, tracing the production of knowledge as presented in the form of narratives, situational descriptions, and various textual accounts. Therefore while this study is not purely ethnographic, it draws on features of ethnographic methods (such as interviews, reviews of official documents and field-based observations) in order to understand the different problematisations of impaired water quality. This was considered to be the best methodological approach because ethnographic style research allows for flexibility in the type of information used, and as

such is not far removed from the sort of approach that we use in everyday life for making sense of our surroundings (Genzuk, 2003).

However, placing too much emphasis on subjective data can also be a source of bias in the presentation of the research findings. For example, how does one measure the extent to which a particular discursive mechanism has influenced a policy outcome? This problem arises in this study in measuring, for instance, the precise level of influence the Board may exert over specific peri-urban issues and concerns. That is why Hardy and Philips (2008) have argued that an appreciation of discourse should not ultimately prevent the importance of 'material' and 'resource' dependencies from being included in the interpretation of the findings. With this idea in mind for the whole duration of the research, the aim has been to link subjective sources of information to the material in a variety of ways: referring to specific examples where policies and tools (such as pollution emission standards) to enforce water quality may fail (e.g. as in the case of regulating water quality in industrial zones in the peri-urban case study); drawing from official documentation (assembled using the Right to Information Act, see 3.6 for details) to ascertain whether a particular discourse is in agreement with or contradictory to the observed realities of impaired water quality in peri-urban areas.

On the basis of the above, this study has consulted a wide range of methods in order to construct the thesis. To name the key ones, information was collected using semi-structured interviews, voice recordings, written observations from fieldwork sites recorded in the form of a fieldwork diary, and official documents obtained from government departments and public libraries. With this in mind, the following chapter justifies the research design and describes how the different sources of information have been utilised to inform specific aspects of the research.

3.1. Conceptual framework and research design

The conceptual framework is based on combining concepts drawn from the science studies and policy studies literatures. Science studies perspectives have been drawn upon to shed light on the relevance of social values as an independent variable for shaping science and technology (Jasanoff, 1987, Latour, 1987, Pickering, 1992, Wynne, 1992). Communities of scientists mobilise their own skills and knowledge for putting forward credible arguments about identifying, selecting and evaluating different policy

options, thus contributing to the framing of water quality in the early stages of the policy process. By contrast, theoretical perspectives of policy studies have helped to trace the translation of formal policies in peri-urban areas. The roles of knowledge/discourse formation, actors/interfaces, and politics/interests are important considerations for presenting a more complete picture of how policies are implemented in local situations (Hajer, 1995, Apthorpe and Gasper, 1996, Shore and Wright, 1997, Keeley and Scoones, 1999). Referring to these two different strands of theory has therefore been useful for creatively expanding what is ethnographically 'in the picture' and for examining the reasons why policies are formulated and designed in particular ways, and then their actual implementation on the ground.

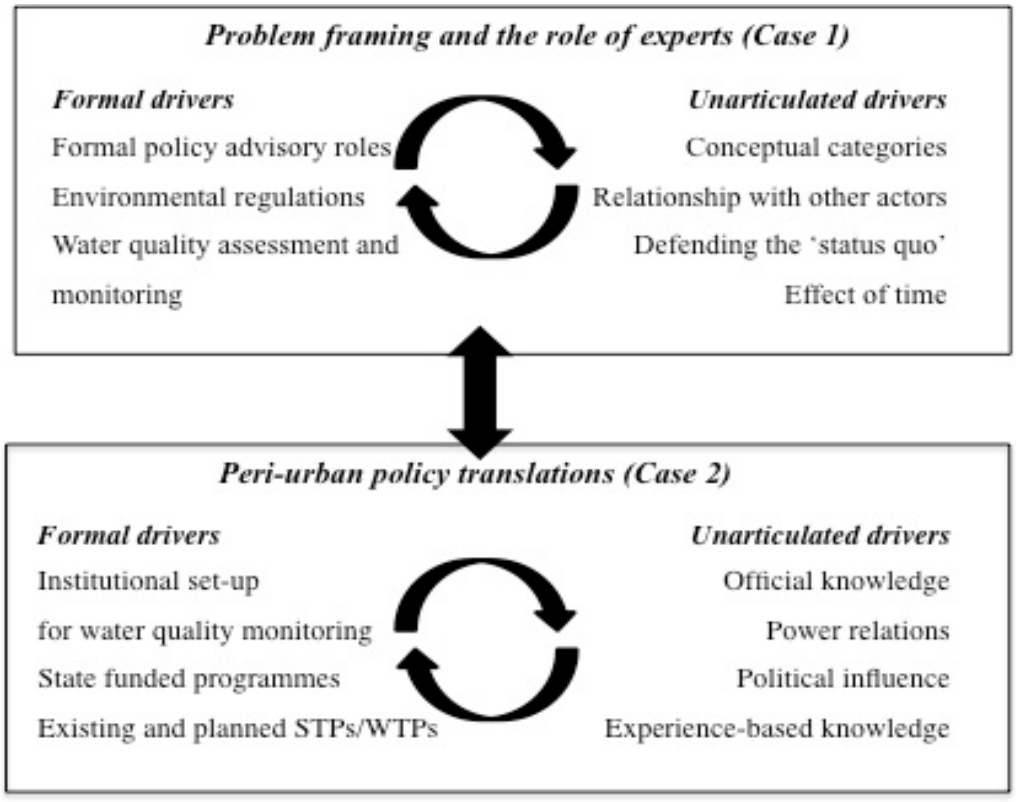

Figure 1: Conceptual framework, own illustration

The research design emanates directly from the conceptual framework and focuses on analysing the two-way interaction between problem-framing and peri-urban policy translations (see also, Figure 1). The use of case studies for exploring this interaction was considered the most appropriate method for focusing the empirical enquiry on a contemporary phenomenon in its real-life context, (Yin, 1994). Case studies are often used to meet different research objectives such as the testing of theory or the

development of new theoretical insights (ibid). In this thesis, a selection of multiple case studies was considered the most appropriate research approach for strengthening the generalisability of the overall findings. Firstly, by developing a sense of the patterns of decision-making occurring at different levels of the policy process, discussed separately in Chapter 4 and Chapter 5. Secondly, by examining the complex interactions that take place between the two case studies, the thesis' critique of expert knowledge in relation to water quality is validated (in Chapter 6).

The examination of the case studies is discursive and aims to outline the influence of competing drivers influencing policy processes at each level. The conceptual framework is meant to capture the influence of both 'formal' and 'unarticulated[16]' policy drivers. The relationship between formal and unarticulated drivers is dynamic and their interaction is understood as having the potential to strengthen the institutionalisation of specific priorities and policy commitments regarding water quality management. In the first case study, formal drivers influencing the Board's functioning are defined as those that are 'officially' recognised and tend to be clearly articulated in policy texts, norms and procedures, such as the Water Act, which stipulates many of the official functions and responsibilities of the Board. 'Unarticulated' drivers influencing the functioning of the Board are less clearly defined and are mostly played out in the discursive realm. For instance, the use of particular discourses to defend the status quo of the organisation, or discursive strategies used to 'play down' uncertainties associated with the approach adopted to monitor water quality can generally be understood as unarticulated drivers that are interpreted by the researcher on the basis of the interviews, discussions and fieldwork observations that inform this case study.

The second case study takes a close-up view of the translation and implementation of expert-driven policies in peri-urban Ghaziabad district. Here the emphasis is on the interaction of formal and unarticulated drivers that influence how policies are executed, contested or re-configured in a local context. It attempts to compare the perspectives of those citizens whose voice is rarely considered in expert assessments of science and technology (Leach and Scoones, 2006, Mehta, 2008) with the 'official knowledge'

[16] 'Unarticulated' drivers refer to those that are part of the policy process yet are not immediately recognisable by reference to policy documents alone. Unarticulated drivers can be distinguished through an analysis of the discursive process influencing policy, as well as by following closely the interactions between different stakeholders involved in both the policy problem formulation and implementation.

associated with water engineers, planners and other actors that constitute the administrative system in Ghaziabad. The aim here is a more careful examination of the nature of policy implementation. For instance, the 'infrastructure' (such as STPs, drains and sewerage networks), which is installed to treat excess wastewater discharged from the district, is a formal policy driver that has an influence in achieving certain water quality objectives (such as improved river water quality). But the installation of this infrastructure can be further influenced by unarticulated policy drivers, regarding for instance the type of residential settlements that are regarded as 'eligible' to be connected to an STP facility. Political influence in the policy process can further play a role in policy implementation by means of encouraging an exercise of 'cherry picking' locations where it is deemed desirable to minimise pollution (i.e. in the affluent residential colonies of the district), versus those locations where policy implementation appears to have little practical impact.

The choice of case studies has been made with the aim of highlighting the contrast that exists between 'peri-urban' policy negotiations and the negotiations that tend to take place at the national level within institutions such as the Board. These can also be described as 'policy spaces'[17] that are contrasting in several ways. At one level, the Board represents a policy space where expert knowledge plays an important role; decision making is highly technocratic and appears to be driven almost exclusively by a model of negotiation based on rationalisation and bureaucratisation; a model which is very much in line for instance with Weber's 'iron cage' portrayal of bureaucracy (Weber, 2002:121). This policy space, one could argue, is of a type that is normally found to exist at a 'macro' policy level and is explored with a view to providing insights as to why even though there is an abundance of regulatory mandates for water quality protection in India, the implementation of these mandates remains problematic, and can be heavily influenced by competing state interests and priorities. For example, the continuation of policies that foster industrial growth with minimum environmental restrictions is often a more dominant state priority, yet is clearly in opposition to the

[17] This is a concept used to suggest that there are specific entry-points or policy spaces that can be identified in the policy process; a deeper examination of these policy spaces can be used to map relevant actor networks, as well as the strategies which are commonly used by key actors to influence decision-making (Keeley and Scoones, 1999).

regulatory mandate to protect water quality in the first place. In this case, Board scientists evidently have to play the role of 'knowledge brokers', having to balance wider state interests with the mandate of environmental protection entrusted to them as pollution control agents.

This 'macro' policy space contrasts with the peri-urban policy space, yet is by no means unrelated. The peri-urban case study is used to demonstrate that there is a unique 'socio-spatial' dimension that influences policy negotiations. The peri-urban case illustrates, for instance, that deeper causes of the deterioration of water quality in a peri-urban setting are not just a matter of straightforward bureaucratic inefficiency. The perpetuation of existing problems is also related to wider urban transformations taking place under the changing urban political economy in India. It is because of the changing political economy that some polluting activities are shifted to the peri-urban space while environmental regulation remains relatively weak. During this process, negotiations take place, and the politicised nature of these negotiations becomes much more visible in this policy space than at the macro level. It is also in peri-urban spaces that variations in exposure based on 'social indicators' (such as class, ethnicity and location within a peri-urban locality) are more clearly visible than from the macro level standpoint. In other words, there is little known about the geography of water pollution and whether it affects mostly middle class or low-income settlements. Given also the diversity of occupations, residential locations and spatial movements within the group of the 'urban poor' and that of the 'middle class', understanding exposure to water pollution becomes even more complicated (Veron, 2006:2100). Exposing this complex and inherently diverse picture of exposure to pollution at the micro level is therefore central for building on this understanding of the policy process, as opposed to the linear 'top-down' perspective of policy procedures. It is also important for broadening the scope of expert-scientific policy frameworks, a subject to which the thesis will turn in Chapter 6.

However, anticipating two likely objections from a cautious reader, I will explain briefly here some of the limitations and biases in selecting the cases to be studied. Firstly, the focus in the selection of cases has been on breadth as opposed to depth in explaining policy processes influencing water quality. That means that in writing up the case studies, I have explored the contrasting accounts which exist on the subject of water quality, as this is the crucial subject that links the cases together. This was a

strategic choice that arose from the research questions. However, the case study selection also has some limitations. For example, in Chapter 4 it could perhaps have been particularly insightful to explore the underlying politics of corruption and particularly to assess to what extent 'agenda setting' can be dominated by political influence or the influence of powerful industrial lobbies. This is an important point especially because lack of transparency is often the one key point of criticism of the Board emerging from environmental NGOs and civil society (CSE, 2009). However, at the same time political influence can be notoriously difficult to assess, given the problems encountered in trying to access sensitive information from environmental regulatory institutions in India (Jasanoff, 1993). As a result, in this research much of the focus in discussion of the Board is on the 'expertise' of the scientists, and how this is shaped by the wider political economy of environmental management. To assess whether the Board scientists themselves are indeed 'corruptible' requires a different line of inquiry, which, despite its relative merits for understanding policy failure, it has not been possible to explore, primarily because of the problems of accessing sensitive information mentioned earlier.

Secondly, the research approach might have benefited from including international policy agenda-setting institutions (e.g. understanding the role of the World Health Organisation in setting water quality standards would make a very interesting line of inquiry). The exclusion of the international level has partly been due to time constraints and also to the inevitable logistical difficulties that limit carrying out research in India and Europe or the United States where the headquarters of international policy agencies are based. Nonetheless, given the depth and complexity of the issues at national and regional levels, and the fact that these are still relatively under-researched, a focus on these two sites was deemed to be the most appropriate research strategy.

3.2. Research timeline

On the basis of the research design described above the fieldwork took place over the course of two visits to New Delhi, India. The Economic and Social Research Council (ESRC) funded both trips as part of my studentship award, and the timing and duration of each trip was as follows:

1st visit: January 10th 2009 – May 10th 2009
2nd visit: November 1st 2009 – April 28th 2010

The first visit involved mainly a series of discussions and semi-structured interviews with researchers, activists, scientists, engineers and civil servants. The choice of interviewees was based on their involvement in different capacities in environment debates, but also on their specific knowledge and professional experiences with regard to water quality. The interview strategy was largely exploratory by nature and was not intended to answer directly the questions pursued as part of the case studies. However, this part of the fieldwork was essential in other aspects. Since this was my first visit to India, an extended stay in Delhi was essential for familiarising myself with the city, the language, and the culture, as well as for managing the overall logistics of my stay.

It was central for making the necessary contacts with informants who would help me later on to identify key actors and institutions for interviews. This first visit also provided me with a greater understanding of the debates related to the policy context being studied. Environmental problems facing Delhi were often a lively starting point for discussions that were particularly useful for appreciating how and by whom water quality problems are commonly framed, as well as for tracing the nature of the policy process and the ways in which it becomes relevant to different domains of society. In order to avoid bias in my engagement with the various actors, I sought to keep a sense of balance by liaising not only with government representatives but also with private firms, academia and non-governmental organisations (NGOs).

After this first visit to Delhi, I returned to the UK for a period to consolidate my early findings and improve the research design. My second visit was dedicated entirely to studying the selected case studies. Fieldwork activities were divided as follows: between November 2009 and January 2010, daily visits were conducted to the Central

Pollution Control Board, based in the eastern part of Delhi. The focus of these visits was to examine specifically the influence of national experts in the framing of water quality, the first case study. Fieldwork in Ghaziabad district for supporting the second case study was conducted in the latter part of my stay from 15th February – 20th April 2010.

Despite having allocated different time slots to investigating each case, the nature of the research meant I had to be constantly mobile, working on both case studies simultaneously. This meant for example that I had to conduct 'one-off' visits to various departments (including the Board) operating within the capital in order to substantiate issues raised during the time spent in Ghaziabad. Therefore, in many ways, as the fieldwork evolved my investigation of the two case studies became more interlinked, since issues emerging at the district level helped me to understand what was being overlooked at the national level. Similarly, having a firm grasp of the regulations and procedures at the national level sharpened up my investigations into the implementation process at the district level. This placed me in a better position for understanding how industrial water pollution in peri-urban areas was linked to various bureaucratic procedures. Finally, to develop my own knowledge of the policy process also meant that I had to refer to additional sources of information. These included short periods away from the fieldwork sites, conducting archival research in institutional libraries and participating in Delhi-based conferences, workshops, and academic talks (more details on this in section 3.6).

Because of the wide spectrum of locations and respondents included in the study it was important to keep a good record of fieldwork observations made during my stay in India. This was done in various ways. Progress reports enabled me to keep a record of how research problems were being shaped during the course of fieldwork. These were regularly communicated to my supervisors allowing feedback and advice to be considered actually during fieldwork. In addition, keeping a research diary and updating field notes on a daily basis allowed me to incorporate information that was based mainly on personal observations and 'quotes'. These sources of information are regularly referred to in the thesis. The next section provides a more detailed description of the methodological approach used to examine each case study.

3.3. Case study 1: Problem framing and the role of experts

This case study is based on an in-depth account of the Board. It focuses on understanding the relationship between formal decision-making and scientific expertise. Broadly speaking, the reasoning behind the specific choice of case studies has been to identify 'critical cases' that are of strategic importance in relation to the overall problem (Flyvbjerg, 2006: 229). A critical case can be one that either verifies or disproves the propositions and assumptions that have contributed to defining the research problem (ibid: 231). The Board's account was selected because it was considered likely to support some of the earlier claims made in part of this thesis about the function (and possible failings) of expert advisory groups in addressing water quality.

In the first place, this is because the Board has a significant claim to expert authority with respect to addressing water quality. It was founded on the basis of the Water Prevention and Control of Pollution Act, 1974 (Gazette of India, 1974), as an exclusive body for coordinating water quality restoration programmes throughout India. Several policies for addressing water quality are therefore directly drafted or arbitrated by the Board. It is active in the design and enforcement of water quality standards, in the implementation of India's national water quality monitoring programme, and in providing assistance to city and district authorities on how to implement related policies (Trivedi, 2008). The centrality of 'science-based' decision-making in the execution of its various roles was the fundamental factor for choosing the Board as one of the case studies.

Secondly, the Water Act also grants a number of regulatory powers to this same organisation[18]. Many of these responsibilities are transferred to State Pollution Control Boards (SPCBs, or State Boards) that oversee environmental regulation at the state, regional and district level. Hence the links with the peri-urban are strong, since important water quality decisions in peri-urban areas are mediated through these 'offspring' institutional branches of the Board. In Chapter 5, for instance, the interaction between the Board and the regional office of the Uttar Pradesh Pollution Control Board

[18] The fact that the Board has accumulated policy advisory and regulatory roles is an intriguing point because it questions the ability of the organisation to function independently. Furthermore although the Water Act explicitly recognises these two sets of roles, the fact that these can intersect is not formally recognised, nor are the implications of this interaction between the Board's roles sufficiently understood. These points are addressed in detail in Chapter 4 and section 6.1.1 of Chapter 6.

(in short, regional office UPPCB) operating in Ghaziabad district, is explored in more detail. It should be noted however, that even though the Ghaziabad district pollution control board and the Board are both part of the same institutional structure, scientists working for the Board rarely had direct contact with peri-urban areas and had limited knowledge of specific details pertaining to water quality management in peri-urban Ghaziabad. This meant that the implications of an expert-led approach for addressing water quality emerged largely from a range of discussions with the scientists on water quality issues in general rather than on peri-urban Ghaziabad in particular.

In order to gain access to the Board I planned to obtain an internship in the head office in Delhi where I would be provided with a temporary membership as a visiting researcher. However, due to several bureaucratic obstacles to having an internship approved within the stipulated period of fieldwork research, I had to resort to a somewhat unorthodox approach for gaining access to the Board. To begin with, using a 'snowball' approach (Patton, 1990) I started off with a small pool of contacts working at the Board. I had become acquainted with them through informal conversations with researchers working for organisations that collaborated with the Board, and academics working in Delhi. During my short visits, I gradually gained the confidence of more members of the Board who took an active interest in my research and I was thus in a position to prolong my visits to the organisation. In a relatively short time my visits became more frequent (normally on a daily basis) and less formal, and at the same time I was able to add to my pool of contacts with members of the Board. Members became familiar with my presence and did not feel threatened by my research objectives. Within the period of three months that I had allocated to this research (see previous section 3.2 for exact dates), I found I was in a position to engage in discussions with both junior and senior members despite their busy schedules. In addition, I managed to join in informal discussions during lunch hours and coffee breaks, which were very informative and would not have been an option if I had been relying solely on scheduled interviews.

Not being a formal member of the organisation, however, did present some difficulties with gaining access to particular sources of information. Basically, Board members did not want to be held liable for sharing sensitive information on regulatory aspects of the management of water quality. For example, the probable contribution of industrial sources to impaired water quality, was looked upon as a sensitive topic that could

critically undermine the Board's authority as a pollution law enforcement agency. So, although Board members were in favour of sharing their knowledge and experience, the fact that I was conducting 'unofficial' visits made them wary of the type of issues being disclosed in the discussions, both informally and during interviews.

This required a certain degree of flexibility in the fieldwork strategy. In particular, the way that I presented my research aims and objectives carried weight for ensuring that visits to the Board would not be compromised. For example, although the failure of regulatory institutions to reach out to peri-urban areas was of interest to this study, maintaining a certain degree of psychological distance from its regulatory functions by focusing more closely on the advisory-scientific functions lessened the likelihood of the Board members putting an end to the research. Although at the beginning this strategy seemed likely to impose limitations, in retrospect it did not jeopardise the overall findings of the research. On the one hand, important insights into the influence of the Board in areas such as water quality assessment and monitoring were still successfully assimilated. On the other, when information on specific regulatory failures in peri-urban areas was needed, it was sought from alternative sources. These included the request of official documents through the Right to Information Act, numerous discussions with independent researchers, and my participation in fora, workshops and conferences taking place in Delhi (additional sources of information are also discussed in section 3.6 of this chapter).

While access was one of the main challenges when examining this case study, the other noteworthy challenge entailed coping with the inherent subjectivity as well as the plethora of information that presented itself during the course of the research. Water quality is a complex subject that touches on various aspects of the Board's routine work and commitments. It is associated with the work of several departments within the organisation and has a core 'administrative' as well as a 'science' element. My background in ecology and the environmental sciences proved to be an advantage because it meant I could quickly familiarise myself with the scientific discussions that took place during my visits at the Board. But my brief previous engagement with social science methodologies also meant that I often found myself despairing when searching for clues as to how water quality problems are played out in the discursive realm. Insights from studies of discourse in an organisational context helped me to cope with

this problem and organise my inquiries in a more systematic fashion. These studies highlight the centrality of exploring the shared assumptions (and shared categories) that tend to be replicated in the Board's practices, discourses, and 'ways of doing things' (Schein, 1991). From a researcher's point of view, it is vital to go a step behind the shared assumptions and beliefs and examine the production of knowledge which forms their base. During the fieldwork, this involved several tasks initially such as familiarising myself with the organisational structure (i.e. division of departments and hierarchies) and then following through, from design to implementation, particular strategies that occupy a more central role in the Board's routine involvement with water quality. As an example, I examine the Board's water quality monitoring programme. This is because the Board invests a large proportion of its financial and human resources in monitoring water quality, and therefore the particular approach adopted for monitoring water quality (e.g. the locations chosen for monitoring water quality) has particular implications for understanding the main beliefs and assumptions that inform the Board's routine work.

Similarly 'texts' (such as annual progress reports) create power relationships through the selection of the types of problems and water pollution concerns that are deemed to be of higher priority. They also provide the basis for establishing those sources of information that are perceived as both authoritative and credible (Hardy & Philips., 2008). Dorothy Smith's sociology has time and again highlighted the fundamental role of texts for understanding the work of 'ruling' within regulatory institutions, corporations and public bodies (Smith, 2005). To a great extent, documents can govern the nature of the institution, in terms of what can be treated as real or relevant in the functioning of an organisation. In the Board's reports for example, the term 'water quality' can be used specifically for highlighting certain interpretations and causes of pollution while obfuscating or undermining others. Interpreting the use of text is therefore essential for gaining insights into how the Board sets its own 'professional' boundaries around water quality problems. In Table 1, a set of open-ended questions

based on different topics show how these perspectives have assisted in exploring the influence of discursive processes in expert decision-making[19].

Table 1: Factors influencing organisational culture, adapted from (Schein, 1991)

Relationship with other actors	How powerful, passive, or harmonious do the scientists believe the work of the Board and State Boards to be? In general, do they see themselves as 'expert authorities' exercising substantial influence on broader issues regarding pollution, or more specifically on water pollution? How are work boundaries defined (in terms of their individual responsibilities in addressing water quality)? How do Board members envisage their involvement with diverse stakeholder groups (e.g. political interest groups, industry and NGOs)?
Effect of time	How has time (since the founding of the Boards) altered the roles, responsibilities and functions of these organisations? How do Board members relate to these alterations? Has the element of time led to significant changes in the ways 'pollution' and water quality have been dealt with (for example, division of expenditures, outside policy priorities influencing the scope of the Board)?
Conceptual categories	What are the underlying scientific assumptions for developing an approach to manage water quality (stemming from engineering, chemistry etc.)? What terminologies are incorporated in every day discourses? To what extent does policy design take into account procedural issues (i.e. heavy pollution impact on peri-urban areas)? What type of standards and activities are more important for monitoring sources of water pollution? Are these standards inclusive of risks that could pose a threat to peri-urban areas? What are the scientific uncertainties that are not expressed in the Board's discourse?
Social effects and environmental integrity	How does water quality, addressed in a very technical context, create dynamics of exclusion for poorer communities (this question is also explored with examples from the peri-urban)? How well do science-based approaches to addressing water quality go along with environmental integrity?

[19] Note that these questions are not the same as those used during interviews and have been derived to inform my own understanding of the Board's functioning. For more details on the questionnaire used during interviews with Board members see Appendix 3.

Over the duration of the fieldwork notes were taken to record observations in real time. These notes focused on aspects of daily organisational functioning, informal discussions with members, and observations of technical work such as laboratory experiments. Semi-structured interview questionnaires were also designed with reference to the topics mentioned in the table above. Questionnaires led to more prolonged discussions with the scientists. The interview strategy adopted is explained in more detail in section 3.5. Approximately 20 individuals have been interviewed as part of the research carried out for this case study. The scientists, academics and NGO representatives that are quoted in this thesis are listed in Appendix 1. Pseudonyms are used to protect the identity of those interviewees who did not want their real names to be disclosed in this thesis.

3.4. Case study 2: Peri-urban policy translations

The second case study is based on fieldwork conducted in the trans-Hindon region of Ghaziabad district in the state of Uttar Pradesh (U.P.), very near the eastern border of New Delhi. The site was first introduced to me through research colleagues at the STEPS Centre, who were conducting fieldwork visits in Ghaziabad district during the same period that I was based in Delhi. The purpose of these visits was primarily to conduct interviews with stakeholders on issues relating to water and sanitation in peri-urban areas, as part of a wider study carried out by the STEPS Centre on peri-urban water sustainability in South Asian cities[20].

By the time I came to know about Ghaziabad district, I had already conducted several field trips to different locations on the outskirts of Delhi. The purpose of these visits was to identify specific geographic locations in the peripheries of Delhi where the accumulation of wastes was increasing as a consequence of Delhi's growth. A secondary purpose was to identify those spaces where, as Amita Baviskar describes, 'smokestack industries, effluent-producing manufacturing units and other aesthetically unpleasant sites, are discreetly tacked away out of sight, polluting some remote rural wasteland' while the capital is transformed into a 'world-class' city (Baviskar, 2002:

[20] In more detail, 'The Peri-Urban Interface and Sustainability of South Asian Cities' is a STEPS Centre project which seeks to bring together the social, technical and environmental dimensions of peri-urban areas. Water was used in this project as an entry point to ask questions of policy, science and engineering, in regard to supply, access and quality. For more information see: http://www.periurbansustainability.org/. Eight core researchers have contributed to this project, which was co-convened by my two DPhil supervisors, Lyla Mehta and Fiona Marshall.

41). Particularly after studying the cool crisp rhetoric of Board members that often led me to assume that everything regarding waste management is in 'order' (at least on paper), identifying a peri-urban site that exhibits symptoms of being bypassed by the formal system of waste management became central to highlighting some of the contrasts that arise when shifting attention away from the more 'scientific' policy framing to a much more politicised process of implementation.

I started my investigation with Gurgaon city (about 32km away from Delhi). I regarded this as a logical entry point to my peri-urban Delhi exploration given that real estate development and the process of land acquisition happening in Gurgaon was receiving considerable media and civil society attention, at the time I was in Delhi, particularly for the agitation it was causing to farmers (Narain, 2009). However, during these preliminary visits and discussions with Gurgaon residents and officials, the issue of water pollution and waste was not so visible nor did the local residents raise it as a serious environmental threat. Local concerns about the water source in Gurgaon appeared to be mainly to do with the 'over-abstraction' of groundwater as a result of urban growth, and less to do with pollution of the water source (Lal Seth, 2011).

It was after discussions with Dr. Pritpal Randhawa, who at that time was leading the fieldwork component of the STEPS 'peri-urban' study, that I considered paying a visit to Ghaziabad. My own affiliation with the STEPS Centre as a DPhil student[21], was helpful in enabling me to join Dr. Randhawa during field trips, and I was also able to participate in conducting interviews and fieldwork observations. During these visits I was surprised to notice the heavily polluted condition of the local river Hindon, and the fact that both local residents and officials were quick to describe the Hindon as a 'dead' river. It also came as a surprise that for local residents, the polluted nature of the river was simply 'no news'; there tended to be mutual agreement that pollution has existed in the district for a very long time.

[21] Funded by the Economic and Social Research Council (ESRC) to carry out DPhil research as part of the STEPS Centre.

For me as an ‘outsider’, conducting research on the ‘distance’ between the macro level of policy agenda setting and ‘local’ level implementation, the perilous condition of the Hindon prompted a number of relevant questions. Firstly, given the relative proximity of Ghaziabad to the capital of Delhi (about 30km distance), why is there no real regulation of river water quality? Especially given that the key national authority for pollution control and prevention, the CPCB (with its main headquarters in in Delhi), operates so close to the district. Secondly, it was equally surprising that despite much of the planning discourse in Delhi being focused on the ‘integration’ of peripheral towns and districts into the urban core (e.g. through policy incentives that stimulate commerce and real estate expansion in the peripheries), why is there arguably so little discussion on the pollution problems which are affecting these areas? For instance, the Delhi 2021 Master Plan makes a casual reference to the environmental degradation of Ghaziabad (particularly the trans-Hindon region, which is closer to Delhi) which is understood to be taking place because of the migration of traditional industries from the city (MoUD, 2007). However, the same plan provides little scope for discussion on the possible implications of environmental degradation for residents of the district, nor on the likelihood of a ‘spill-over’ of pollution from Ghaziabad into the capital. Given also that the relationship of Delhi with its peripheries is usually explained in terms of the impact of population explosion, commerce and real estate development (as in the case of Gurgaon), my early visits to Ghaziabad suggested that there is much more scope for examining Delhi’s peri-urban transformation from the perspective of water quality.

I began my exploration firstly with the intention of understanding why deteriorating water quality remains so poorly addressed in the district. Furthermore, I wanted to draw from the fieldwork deeper insights into the ‘interconnectedness’ of different water quality risks, and to understand better how these are presented to diverse social groups residing in the district. Specifically in this case study, the fieldwork attempted to bridge two foci. The first is a focus on the water resources: to develop an understanding of what happens to the river and the groundwater that at present seem to be only the recipients of wastewater. And following on from this, to understand how this failure might be perceived by residents, government officials, and scientists operating in the district with different roles (such as health, water and pollution control specialists). The intention of this inquiry was to illustrate that implementation of water quality policies in

a peri-urban setting is often negotiated amongst diverse stakeholders who may often 'frame' the problem of water pollution in rather contradictory ways.

The second is a focus on the particular 'socio-spatial' relations that determine exposure to risk from deteriorating water quality. This required an approach to data collection that could unpack the preconceived notion that deteriorating water quality has the same impact across all types of populations found in the district. For instance, while it is generally recognised that following a Delhi Supreme Court judgment, many polluting industries from Delhi have relocated to the peripheries (see also, Navlakha, 2000), it is less understood whether there are particular 'hotspots' where these industries tend to operate and whether such hotspots correspond with residential settlements, particularly those of the poorest peri-urban citizens. This 'socio-spatial' dimension of exposure was further explored with particular reference to the level of access of different social groups to wastewater and water treatment facilities.

To address these two focal points I weaved my way through a diverse array of data sets, elicited by way of several data collection techniques, adopting a fieldwork strategy that, in hindsight, appears to have grown by way of an 'outward layering' of data sets. Guided by few prior assumptions about how problems of deteriorating water quality were created in the district, I attempted to trace the relations between individuals and groups who appeared to define and debate the problems, or appeared to be involved in the exercise of solving them. Starting from the 'official' representation of the problems (i.e. the pollution of the river Hindon, the unregulated disposal of industrial effluents, the depletion of the groundwater etc.), I gradually expanded my field of inquiry to include other perspectives from other professional and cultural spheres including members of NGOs, environmental activists, journalists, and citizens from different socio-economic backgrounds. This outward layering approach to conducting the fieldwork led to a widening of the 'geographical' space examined (i.e. inclusion of new field sites), as well as gradually developing a richer understanding of the types of discourses and framings related to the core water quality problems affecting the district. However, this outward layering of data also meant that integration was a continuous challenge, where I regularly had to come to terms with the inherent limitations of trying to integrate data from fairly distinct cultural spheres.

I started my engagement with 'official' representations of deteriorating water quality with the regional office of the Uttar Pradesh Pollution Control Board (UPPCB). Given my prior engagement with Board scientists, I was interested in exploring whether pollution control officials at the district level were likely to share a similar vision to pollution control scientists working at the national level. When that was not the case, my aim was to explore what the 'grey' areas of divergence or contradiction were. To guide my inquiries I developed the following open-ended questions:

- *How do perceptions of risk pertaining to water quality differ between Board scientists and pollution enforcement officials?*
- *How do officials interact with different social groups?*
- *How enforceable are the water quality criteria and standards proposed and developed by the Board in a peri-urban context?*
- *What types of technological and formal policy interventions exist in peri-urban areas for addressing water quality?*
- *How do power relationships bring about the persistence of water quality deterioration?*

After a few visits to the regional office, UPPCB, I realised that eliciting responses from pollution control officials to these kinds of questions could only be partially achieved. I found, for instance, that because of my own identity as a 'foreign' researcher, officials were puzzled about the underlying motives for my research. If I had been a pollution scientist myself, interested only in the technical performance of existing wastewater treatment installations, and the scientific methods available to officers for monitoring water quality, I could sense that discussions would have flowed much more easily. By contrast, if my study was intended to expose 'internationally' the underlying politics of bureaucratic inefficiency, particularly in their own domain of pollution control, officials would have to tread more carefully in responding to my questions. Despite my efforts to distance my own identity as a researcher from these rather polar positions, communicating the objectives of my research in such a way that I was not considered 'threatening' to the organisation was a constant struggle.

In retrospect, I can see that carrying the identity of an ambiguous foreign researcher generated obstacles that blocked access to 'deep data' concerning the day-to-day functioning of the regional office, UPPCB. For instance, one morning I was taken on a tour of the river Hindon (i.e. the stretch of the river that passes through Ghaziabad district) by two of the regional office UPPCB employees. By car, we took a route upstream along the river, noting points at which pollution control officials took regular samples of water for further water quality testing. However, when I inquired whether we could visit points of industrial effluent disposal (e.g. by entering some of the industrial premises), or enter the government operated wastewater treatment plants to which some of the wastewater was being diverted prior to entering the river Hindon, my request was simply denied. Upon return to the regional office, I asked the director of the regional office UPPCB the same question, to which I received another negative response. The reason quoted was that I needed 'special permission' to enter industrial premises, and the process of obtaining such permission was, I felt at times, left deliberately ambiguous.

With many questions left unanswered from my visits to the regional office, UPPCB, I moved between different bureaucratic spaces to gain a sense of how officials working in other government departments understand (and possibly intervene in) problems of water quality. I found that by changing my own vantage point I could achieve a level of access to official decision-making processes that would not have been possible if I had confined my investigations solely to the role of the regional office, UPPCB. I visited local offices of the Uttar Pradesh Jal Nigam (the Uttar Pradesh Water and Engineering Board), the Ghaziabad Municipal Corporation (Nagar Nigam), the waterborne disease monitoring agency based at the district hospital (operating under the Integrated Disease Surveillance Programme) and the district offices of the Uttar Pradesh State Industrial Corporation (UPSIDC). On some occasions when access was granted, I also visited government offices within the premises of wastewater and water treatment installations in order to gain a better understanding of the role of technological applications in managing water quality in the district.

My visits to the different offices were initially guided by limited information as to how water quality management relates to other departments in the bureaucracy. Since my first point of departure was the regional office, UPPCB, I asked pollution control

officers to provide me with contacts of officials that I could approach in other government agencies. After a considerable amount of meandering around the periphery, of bureaucratic decision-making, I slowly built my own 'mental map' of relevant official stakeholders and developed a pool of contacts in different departments that I was able to approach for interviews and informal discussions. Thus the sampling strategy, at the level of understanding formal policy processes in the district, was primarily the result of a gradual process of learning the 'official system', as opposed to having a predefined 'list' of officials and departments for conducting interviews.

By keeping myself mobile and moving between different official agencies, I was able to construct a more complete picture of the water quality problems affecting the district, going beyond the 'biophysical' representation of the problems (i.e. the ecological deterioration of the river Hindon[22]). For instance, it was after several meetings with Dr. Shastri, a microbiologist working at the district hospital, that I came to know about the names and locations of villages and slum areas where water used for drinking purposes was obtained from tubewells and was regarded by hospital officials as 'unsafe'. It also turned out that the hospital was conducting its own water quality assessments, but these assessments were rarely communicated to pollution control officials. I was also surprised to learn that waterborne diseases did not unequivocally signal the failure of government or stir civic consciousness amongst officials. On the contrary, many officials would blame water users[23] for contracting illness and held them accountable for their own misfortunes. As I gradually included more official actors in the fieldwork, my understanding of how professional boundaries are formed deepened: a process which later on allowed me to draw my own conclusions about the interplay between the technical and the political representation of water quality problems.

In the layering effect I was creating, it was also important to include the perspectives of the citizens themselves, and to develop deeper insights into how problems of water quality are embedded in their daily lives. I also wanted to show the contrast between the 'official' knowledge of water quality and the 'experiential' knowledge of citizens. To realise this aim during the fieldwork demanded a fair amount of crossing-over activities. Initially, I identified public spaces where I could hold informal conversations with

[22] This subject came up frequently in discussions with pollution control officials of the regional office, UPPCB.
[23] This was the case for water users coming from lower socio-economic backgrounds.

residents of the district. I met with residents at typical Indian tea stands (in Hindi, a 'chai wallah') and at local restaurants, and probed them to describe their understanding of problems of environmental pollution in the district. I also met with local shopkeepers and became a participant observer at police depots, to develop a better understanding of particular 'hotspots' of pollution. For instance, residents often referred to the owners of 'illegal' factories as being the major perpetrators of environmental regulation. I therefore asked questions that would allow me to develop a better understanding of where these factories are located, and whether there are any residential settlements in proximity to industrial areas.

Midway through the fieldwork and after I had developed an overall impression of the social and environmental topography of the trans-Hindon region, I narrowed down to specific field locations where citizens encountered different water quality risks on a regular basis. These sites were identified mainly by inference from my discussions with citizens and government officials. I understood that citizens from lower socio-economic background residing in the urbanised villages, commonly located in the proximity of industrial estates, were exposed regularly to both domestic and industrial sources of pollution. However, deteriorating water quality in these areas was often ignored or downplayed in official representations. I therefore selected Arthala village, KarKar Model and Maharajpur village to develop insights regarding the ecological and urban settlement conditions of these spaces. I guided my queries with a set of open-ended questions that explored native understandings of water pollution. I asked residents to describe specific elements or instances of pollution, and in the process attempted to synthesise a more a complex picture of the type of water quality risks (and causes of those risks) presented to poorer peri-urban citizens.

During the entire length of the visit I benefited from the assistance of Sushil Raghav, a local resident and committed environmental activist[24]. His engagement with environmental activism in the district helped me identify field sites that were of strategic interest to my research aims. Barred from the everyday functions within industrial sites, I was often forced to view industry from outside their physical

[24] A video documentary in which Sushil Raghav offers his own views around water pollution and access in peri-urban Ghaziabad district, see the STEPS official website on peri-urban sustainability: http://periurbansustainability.org/resources/item/water_and_justice_peri_urban_pathways_in_delhi?filter=resources&list=true&theme=sustainability

boundaries. With the support of Sushil, I was able to identify bypass drains and effluent disposal sites that industrial operators strived to hide from view (i.e. using concrete blocks). With Sushil, I also visited the rooftops of houses to obtain a more critical understanding of the spatial topography of environmental pollution. It was this 'higher' vantage point for instance that opened my eyes to the irregular pattern of smoke formation above industrial sites, which I later came to realise was due to the fact that some industries regularly interrupted the functioning of their air pollution control equipment in order to reduce their pollution abatement costs. Apart from locating sites where polluting practices lay 'hidden' from the public eye, Sushil also helped me on several occasions to overcome language barriers by acting as a translator during discussions with citizens who did not speak English. In addition, the fact that Sushil knew or at least recognised many of the village residents in the sites that I chose to study was a powerful ice-breaker and helped respondents feel more comfortable and conversational during interviews.

Approximately 30 individuals have been interviewed for this case study. The district officials, village residents, scientists and NGO representatives that are quoted in the discussion of the peri-urban case are listed in Appendix 2. Pseudonyms are used to protect the identity of those interviewees that did not want their real names to be disclosed in this thesis.

3.5. Interview strategy

The interview strategy can take on different forms and yield a variety of information, depending on the person being interviewed. The interviewee's own position in relation to the policy process can be very different, and this is what determines the type of experiences and perspectives that are introduced for discussion. Consequently, the interviewee's status as a scientist, a bureaucrat, or a powerless citizen holds different implications for the way an interview proceeds.

With this in mind, different questions were put to the different groups of actors. That is, during my engagement with Board scientists I asked them a different set of questions from those I used in the Ghaziabad case study. The protocol followed was to send a short one-page brief by email, outlining the research topic and main questions, in order for respondents to have some knowledge of the topic prior to the interview. Because of

the nature of the organisations under study and the difficulties inherent in gaining access in bureaucratic contexts, often more than one appointment was necessary to secure an interview. Sending out briefs in advance did not always guarantee that that they were read or that respondents were always prepared to answer questions directly. Generally, it was necessary to be flexible when using prepared questions, and sometimes respondents were encouraged to speak more freely. Very often scientists and officials were reluctant to give their consent for their real names to be disclosed. For this reason quotes from interviews with officials and scientists used in this thesis are attributed to their roles and functions but their real names have been replaced with pseudonyms in order to protect their anonymity. An example of the interview schedule is provided in Appendix 3.

Most interviews were ‘semi-structured’, where detailed questions are formulated ahead of time, starting with more general questions or topics. Should the interviewee introduce new information that was not part of the proposed interview plan, the interview could alter its course to accommodate them (Creswell, 2009). This was crucial when interviewing Board scientists because although members shared similar views, they reported their individual experiences, influenced by their positions and specialised functions in the organisation. It is noteworthy that for example discussions with laboratory workers provided deeper insights into scientific ‘uncertainties’ when measuring water quality in the lab and comparing the findings with regulatory ‘standards’ (these features of the Board’s work did not figure as prominently during arranged interviews). Senior members who had been in the organisation for longer were able to elaborate on the organisational history and its relationship to other actors such as the MoEF. As it was difficult to anticipate the kind of information the respondent would be willing to share, it required openness and scope for re-adjustment of the questions during the interview process.

In some interviews I applied a more ‘conversational’ style of engagement. Particularly during my first visit to Delhi, ‘elite’ interviews with academics, policy practitioners and other experts allowed me to get a first-hand view of how problems regarding water quality are understood by those working outside government. In fairly unstructured interviews, I also approached retired officials, scientists, and engineers who were in a position to discuss issues from the ‘outside’, recalling their own past professional

experiences, and revealing their personal views of the contemporary situation. This type of engagement was facilitated by using open-ended questions suggested by the researcher or that arose spontaneously during the interview (i.e. 'Tell me more about...', 'Could you elaborate on the point you just made?' etc.). These kinds of interviews often tended to take significantly longer than others, sometimes lasting several hours.

The majority of interviews with public officials, scientists and other policy practitioners were conducted in English. However, people from poorer groups residing in urban villages who were regularly affected by environmental pollution often responded in Hindi. As mentioned previously, Sushil normally translated these for me during the course of an interview. Obviously this placed restrictions on the interview strategy, since not all subtle meanings and details can be translated on the spot. Being aware from the start that Hindi being the main language spoken in the villages could affect the quality of the data obtained, I customised the fieldwork strategy accordingly. Discussions were held with Sushil after walking around the locality and gaining a better sense of the environmental issues affecting the settlement. After identifying the specific sensitive areas such as waste management efficiency, use of water resources, and local sources of pollution (e.g. proximity to industries was regularly flagged as a community concern), interviews were then conducted in an exploratory way, encouraging village residents to present their views on these problems. The point was therefore not to ask respondents abstract questions about how they felt about 'water quality' (as this is more of a scientific term) but to infer those problems and concerns that were of interest to the residents.

Information drawn from interviews and used in the form of quotes is a central component of this thesis. Quotes are taken from the interviews, and are referenced in the thesis in the form of footnotes. The overall aim has been to refer to quotations in order to illustrate how different aspects of water quality were emphasised by different groups of actors. Interview quotes are also utilised for illustrating how involved actors portray institutional relationships and how formal responsibility is shared between the actors involved in the enactment of formal policies and interventions. Although only a part of the interview material is presented in this thesis, the bulk has had a supporting role in deepening my own understanding of the issues and in formulating the key arguments.

3.6. Additional sources of information

Coming to terms with the different meanings, contrasting knowledge systems and interventions attached to water quality also involved engaging with a diverse range of additional sources of information. The main additional sources that influenced this research included official documents accessed via the Right to Information (RTI) Act, 2005, government audit reports dealing with regulatory institutions, and participation in workshops and other fora as part of my affiliation with the STEPS Centre. Each of these sources is described briefly in this section.

Access to official documents from government departments operating at various executive levels (i.e. national, state and district) is often discouraged. This was a major setback when claims made by respondents during interviews needed to be further substantiated. It also hindered the research in getting to the bottom of the official rhetoric of senior civil servants and scientists and in examining the facts in more detail. It is in this context that the use of the Right to Information Act, 2005 proved so important. Starting with small-scale sporadic initiatives, RTI has now become a nationwide people's movement for exposing corrupt government practices by gaining access to government information. Specifically, the RTI empowers citizens, research NGOs and civil society groups to scrutinise government decisions and to ensure that they are consistent with the principles of public interest, probity and justice (Mander and Joshi, 2010). By using the RTI Act, 2005 this research was able to gain access to valuable sources of information that would have otherwise been unavailable, if the methodology had relied on fieldwork observations and interviews alone.

Not being an Indian national meant that I could not apply directly for access to official documentation. Sushil Raghav who was also helping me during my fieldwork in Ghaziabad district agreed to send the RTI requests in his name and with his authorisation. This became an effective partnership as on the one hand I benefited directly from answers received and on the other hand, Sushil also benefited by extending his knowledge and information sources to support his own environmental

activism in the district[25]. Although the procedure seems simple, there are several points that require careful attention in order to ensure the quality of the information received through RTI. For example, questions posed to government departments have to be carefully worded in order to ensure that answers received from officials are not misleading. To some extent this requires some prior knowledge of the organisation to which an RTI application is filed. These are aspects of using the RTI that I had little prior knowledge of, but with Sushil's prior experience I was able to submit effective applications which returned valuable official information.

Given the centrality of environmental regulatory institutions to the investigations carried out as part of this research, the majority of RTI requests were made to the Board and UPPCB regional office in Ghaziabad. Different questions were put to the departments concerned, on the basis of how my understanding of the key issues developed over the course of the fieldwork. In the case of the Board, questions were primarily focused on details of bureaucratic practice and organisational structure. The questions posed concerned public complaints received by the Board on issues related to pollution, minutes of meetings of Board members, inspection of industries carried out under specific pollution enforcement initiatives, and details regarding the annual allocation of the Board's financial budget. In the case of the regional office, UPPCB, questions were primarily focused on details of pollution enforcement practice. These included details of the locations within Ghaziabad where water samples are collected, factories operating in the district which failed to comply with environmental norms, and the frequency with which pollution enforcement inspectors visited villages, residential colonies and other departments within the district. On the basis of the information received I was able to develop a better picture of the numbers of industrial units operating illegally in the district. I was also able to form better judgments about the water quality status of various water resources in the district.

[25] An important area of Sushil's involvement with the RTI process that overlaps with the interest of this study has been in exposing industries that operate either illegally in the district or without effluent treatment plants. He uses information received through the RTI to approach pollution control authorities and put pressure on regulators to take remedial action.

Nonetheless, it should be noted that there are several constraints to using the RTI Act. The first relates to the time it takes to receive a response following an RTI request. This usually takes up to 30 days, depending on the nature of the request and the number of questions put to the department concerned. Given that my fieldwork proceeded in two relatively short visits of approximately three months each, I could not afford to rest entirely on the RTI process, and simply wait idly for the departments concerned to provide a response. Once I received the information I carefully examined it, but the fact that I could not predict when this would be meant that I had to treat information provided using the RTI Act essentially as a secondary source of information, while interviews and fieldwork observations were the 'primary' source[26].

The second limitation relates to the quality of information received. Ultimately, the RTI Act has been mobilised by civil society in India to identify specific problems faced by people in their interface with the public authority (Mander and Joshi, 2010), and, more specifically, problems that relate to corruption, or the exercise of power in ways which adversely affect citizens. This means that officials are not always comfortable with answering questions put to their departments on the basis of the RTI Act. As a result, it is not always certain that documents received have not been altered, or that officials have not withheld specific information and documents. Another, simpler, strategy for officials to prevent the disclosure of sensitive information is to provide 'short answers' to questions that relate to contentious topics, such as in this case the topic of industrial pollution regulation. These issues meant that I was cautious in how I used RTI information, and in many cases I observed that the 'real problems' and the respective causes of bureaucratic failure were identified much more easily during interviews and informal discussions than when I used the RTI Act. Generally, however, it must be said that the quality of information received using the RTI process depends largely on the questioner's experience of making the information requests, and because officials are likely to be 'defensive' in the responses that they provide, usually a number of RTI requests have to be sent to the same agency in order to put pressure on officials, something which in turn requires more time than was available for the completion of this research project.

[26] For an example of an official response to an RTI request refer to Appendix 4.

Another source for collecting additional information was a series of short visits to government institutions including Parliament House, the National Institute of Public Finance and Policy, the Indian Institute of Public Administration, and the Comptroller Audit General (CAG) of India. Specifically, the aim of these visits was to locate reports prepared by independent auditory bodies and committees of experts on the performance of environmental regulatory institutions, especially the Board and State Boards. Examining these reports was important for understanding how the state mobilises its own evaluation of regulatory performance and implementation, but also for interpreting how these evaluations have evolved over time and especially since the establishment of the Board. Not all reports are referred to directly in the text. However, those that are referred to in this thesis include the Comptroller and Auditor General Review of the Board (CAG, 1992), as well as the more recent audit of the Board by the Parliament Standing Committee on Science & Technology, Environment & Forests (Parliament of India, 2008)

As already mentioned, during the course of the research I attended several fora that proved to be an invaluable source for the data collection process, and for participating in discussions related to this research, as well as gaining access to individual experts and documentation. As a member of the STEPS team[27], my study has benefited greatly from my attendance at a series of 'peri-urban' specific workshops, academic discussions, and access to research papers and documents related to the STEPS peri-urban project[28] . These sources of information have been invaluable for formulating ideas as well as for triangulating and substantiating information received during the fieldwork. Because the STEPS project's focus was on exploring questions of water 'supply and access' as opposed to water 'quality', there are several points of intersection but also of departure between the STEPS project and this thesis. They differ in terms of their emphasis, with this thesis being more oriented to water quality and not just to issues of supply and access, while also adding another dimension to the discussion by introducing the Board's role in the process, which is not accounted for in the STEPS project.

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[27] Funded by the Economic and Social Research Council (ESRC) to carry out DPhil research as part of the STEPS Centre.

[28] 'The Peri-Urban Interface and Sustainability of South Asian Cities' is a STEPS project that seeks to bring together the social, technical and environmental dimensions of peri-urban areas. Water is used in this project as an entry point to ask questions of policy, science and engineering, with regard to supply, access and quality. For more information, see: http://www.periurbansustainability.org/.

3.7. Ethics and Confidentiality

Ethical considerations required that I ensured informed consent of participants in the research, thereby protecting the interests of the subjects, maintaining confidentiality, and preventing the disclosure of identities where it could harm those participating in the research (Hill, 1995, in Mehta, 2007). Therefore, in the case of the institutional study of the Board, the research objectives were always made explicit from the beginning as well as throughout the time spent visiting the organisation. Reference letters from my University were made available as and when requested or before an interview commenced.

Prior to initiating interviews, meetings were held with senior members of the Board for presenting the research plan and for ensuring that the organisation was aware of and comfortable with my visits. As mentioned previously, all interviewees are kept anonymous in the empirical chapters that follow. This decision was taken because of the sensitive nature of the field of study, which relates closely to regulatory practices, policies and performance.

3.8. Funding

The research was funded entirely through a +3 Economic and Social Research Council (ESRC) scholarship. This scholarship included a living allowance for the period of the doctoral programme, and also provided additional funding for overseas fieldwork, which allowed for significant time and resources to be dedicated to collecting information abroad. As previously stated, nine months were spent overall conducting fieldwork in New Delhi, India.

3.9. Reflections on the methodology

The research task I embarked upon was an ambitious one, particularly because of the nature of the case studies that I wanted to explore. It is not common practice for research on peri-urban processes to include a fieldwork component at a location that is physically situated 'outside' the peri-urban context. However, in my research I did precisely this by including the case of the Central Pollution Control Board. This is an expert-led organisation, performing all the tasks of a national policy advisory body on water quality management, but situated in the capital of Delhi instead of peri-urban Ghaziabad. In doing so, my intention is to show how these two different worlds of policy action can be at the same time 'contrasting' as well as 'similar', and to illustrate the 'cross-scale' interactions that can influence policy success as well as failure. This is important both in terms of being consistent with the conceptual framework that informs this study, and for illustrating how problems of water quality are defined from multiple perspectives. But at the same time in moving across these different worlds, cultural as well as geographical, dilemmas arise, puzzles confound and social relations are formed that shape the final written output. I would like to list a few here to give the reader a sense of how the process of research and fieldwork has influenced the researcher in a more personal way.

First is the issue of maintaining a position of neutrality when engaging with multiple, and often adversarial points of view. Who are to blame for the persistence of water pollution in a peri-urban setting, and who are the victims? And more importantly, where does one draw the line between the *science* and the *politics* in understanding the underlying causes of water pollution? I pondered these types of questions throughout this research journey, and in many situations I found myself being pulled between different positions. Particularly in my exploration of the Board, I attempted to present a 'balanced' account of how water quality management is perceived both from the perspective of the scientists working 'inside' the organisation, as well as from the point of view of other stakeholders not immediately related to the functioning of the Board. These include activists working for environmental NGOs based in Delhi, academics and former employees of the Board. But when it came to doing the research, I could sense that the risk of privileging certain perspectives or misrepresenting others always loomed large.

For example, I sometimes wondered whether I was identifying too much with the environment NGO positions I encountered, particularly the position of activists based in Delhi who were normally fierce critics of the Board. During my engagement with Sushil Raghav and in the process of searching for 'clues' to corrupt industrial and government practices, I often found myself feeling frustrated with the pollution problems I encountered and became acutely aware that these feelings could lead to biases and weaken my own capacity to maintain an objective stance in my own interpretations. Equally, there were times when I questioned whether my prolonged engagement with Board scientists was bringing my own views too close to theirs, particularly because I had to learn a lot about the actual 'science' of water quality management before I could come to write about it from a critical point of view. I therefore found myself in doubt about whether I was replicating the same explanations for water quality problems I encountered that the scientists discussed with me, or whether my own engagement was indeed fruitful for identifying 'grey' areas and possible limitations in the science. I found that resolving these dilemmas took time, and only after attaining a certain degree of distance from the subjects of my research, for instance only after coming back to the UK, was I able to look at my data with some degree of impartiality. But more generally, managing the dangers of misrepresentation and the inevitable difficulties of having to be both impartial and involved with my research subjects was at various times a source of tension.

Secondly, personal dilemmas arose in the process of data collection. Early on in the fieldwork I used a pre-designed questionnaire as my primary method for data collection (see Appendix 3). This questionnaire was designed on the basis of certain expectations, particularly regarding the level of access to information I could gain from the respondents working in the organisations I was interested in. However, in the event, I discovered that the contexts I was studying were much more challenging than I had earlier anticipated. For instance, when I met with some officials in Ghaziabad, I would frequently receive fragmented stories and partial 'yes' or 'no' answers to questions I was expecting a fair degree of elaboration. Given the central role of discourse in this research, this quickly became a serious obstacle to my data collection strategy. It also made me question the usefulness of questionnaires in the Indian bureaucratic setting, where I found that the officials I was engaging with were keen to keep their knowledge and experiences secret.

This problem is not easily overcome, but after spending some time in the field I found that developing 'partnerships' with a small number of actors became a useful strategy for overcoming some of the difficulties of access. One such partnership building exercise was with Dr. Shastri, a microbiologist working for Ghaziabad hospital. Yet another was with environmental activist, Sushil Raghav (see also section 3.4). Also, at the level of understanding how the Board functions, I decided to interact more closely with a small number of scientists as opposed to all the scientific staff that were employed by the Board. To develop these partnerships I deviated considerably from the standard questionnaire approach. I invested considerable time in getting to know my research partners; I met with them regularly, and accompanied them to their place of work. I took time to interact with them at a social level and met them outside their normal office hours as well.

The limitation of building such partnerships with the research subjects, however, is that it can be a rather slow and time-consuming process. For instance, only after meeting with Dr. Shastri regularly at his office over several months was I able to take note of his 'own' views regarding the pollution problems affecting the district. This differed strikingly, for instance, from the normal rhetoric of officials in the district, which focused mainly on 'listing' the functions of his or her respective organisation. Similarly, only after my meetings with Sushil became more regular (i.e. on a daily basis, when I was conducting fieldwork in Ghaziabad), was I able to gain his trust and use some of the official documents he had collected over several years of exercising his rights under the RTI Act. If I were conducting this research in a different setting, where there was perhaps less secrecy around official decision-making processes, a structured questionnaire would have been a more useful methodological tool, and presumably would have allowed the research to draw insights from a larger pool of respondents. But given the issues of access encountered both in the context of the Board as well as in peri-urban Ghaziabad, many of the main insights of this research are drawn from the partnerships which I formed with a relatively small group of actors.

A key aim of this research has been to bring to the forefront the perspectives of those citizens who are often excluded from expert and technical framings of water quality. However, as Mehta has also highlighted, researching marginality can often be a complex task (Mehta, 2008). Although I have tried to provide an honest portrayal of the events I experienced while engaging with marginalised citizens, I was also aware that the risk of essentialising certain citizen views and accounts was always present. For instance, it was not always straightforward to establish clear links between marginality and exposure to deteriorating water quality, not least because at some level, water pollution was having visible negative affects across different social classes.

In rapidly changing peri-urban contexts where there is often widespread environmental degradation, identifying who is being marginalised and who is better served poses even greater challenges. In Ghaziabad, the middle-classes, although less vocal about problems of water pollution, were also affected in important ways, for instance because of the proximity of the polluted river Hindon to their location of residence, or because it was evident to them that wider policies drawn at the capital made serious concessions to environmental protection when it came to managing the towns where they chose to live. I decided to 'single out' citizens residing in the villages on the basis of how these spaces were represented in official discourse, and the fact that in these spaces peri-urban citizens faced risks that were seriously harmful and at times even life threatening, as highlighted by my experiences. However, in practice, when conducting social science research these choices can often be highly arbitrary and heavily influenced by the way we as researchers experience marginality. In other words, investigations proceed sometimes through a certain degree of intuition, which arises from being situated at a particular place and at a particular point in time (Mehta, 2008:237).

Finally, in my engagement with those citizens regularly exposed to risks from water pollution, the fieldwork was on several occasions confounded by problems of communication. With environmental activists and scientists, literacy was valuable to the extent that exchange of knowledge could generate a certain measure of partnership building. In my engagement with citizens, however, this exchange had numerous unstable moments. I can recall that after one of my visits to the village settlements, an article appeared in the local newspaper that noted in the headline that 'a researcher from the UK' had visited the villages to study problems of environmental pollution. This

made me rather conscious of the type of impact my research was having on the communities I was studying. I did not want to create false expectations, nor to adopt the image of a 'social benefactor' for the communities I studied. I have tried to overcome the dangers of being misunderstood by creating the time and space needed for research participants to get to know me, in the same way that I was aspiring to learn more about their own lives. But as Mehta suggests, it often cannot be helped that as researchers 'we can be painfully aware of the power relations that shape our research, and the fact that that most of us conduct research from positions of privilege about people in difficult situations' (Mehta, 2008:248). In these circumstances, all players know that they are vulnerable to being misrepresented, while language differences can only accentuate the problems.

3.10. Conclusion

This chapter has attempted to describe the methodology used to collect and analyse the data for this research. I have discussed the research strategy and how it has been used to develop deeper insights on water quality policy processes. The methods of data collection have been described and the methods used to explore the separate case studies have been outlined. Finally, I have discussed briefly some of my own reflections on the methodology, its limitations and how something of my own position as a researcher may have come to shape the final delivery of the pen.

Chapter 4 Expertise and decision-making at the Board

This chapter turns its attention to the Central Pollution Control Board (hereafter known as the Board), which is often described as being the 'technical arm' of the Ministry of Environment and Forests (MoEF) for environmental pollution regulation and abatement. Within government, the Board is the scientific organisation almost synonymous with 'environmental expertise' and it operates as a principal advisory body for a number of stakeholders, including policy makers and regulators. The Board was first founded in Delhi in the early 1970s by a team of scientists and engineers specialised in the field of environmental pollution. This was a time when river pollution was a major concern. Although river pollution formed the basis for developing comprehensive guidelines and research strategies for addressing 'water quality', the Board has now grown significantly and operates as a national level organisation for pollution prevention in India.

With its main roles being centred on the design and enforcement of water pollution prevention strategies, the Board represents a useful starting point for exploring the influence of expert advisors on the development of water quality priorities. The insights of this chapter are informed by the examination of the particular ways in which scientists routinely talk about water quality, linking concepts and scientific notions with specific policy priorities. The chapter further illustrates, by way of a set of narratives[29], the type of shared assumptions and biases that have become internalised by the Board scientists with respect to water quality regulation.

[29] The narratives referred to are: The deteriorating levels of water quality (caused by overpopulation), the development and enforcement of standards, the locations chosen for monitoring and the relationship between the Board and civil society.

4.1. The Board and the context of environmental policy in India

Environmental policy in India emerged as a priority in the seventies and acquired public appeal in subsequent years. It is argued that the enactment of environmental laws and employment of a range of regulatory instruments in India emerged firstly as a response to global environmental policy initiatives and secondly because of the realisation of an environmental policy agenda by India's policy makers (Dwivedi, 1997). The international stimulus came primarily from the 1972 United Nations conference on international environmental issues held in Stockholm (also known as the Stockholm Conference). India, was both a participant as well as signatory to the environmental principles decided at that time (Bajwa and Bains, 1992). Since then, a number of landmark regulatory reforms have been pursued domestically including the Water (Prevention and Control of Pollution) Act of 1974[30], The Forest Conservation Act of 1981, The Air Prevention and Control of Pollution Act of 1986, and the Environment (Protection) Act of 1986. These legislations have facilitated a paradigm shift from a system of environmental law that mainly consisted of tortuous actions against nuisance or negligence, to a system that endorses specific priorities for individual sectors and problem areas (Divan and Rosencranz, 2001).

The Board and State Boards have emerged as part of this process of institutional and regulatory reform and specifically as the key mechanism for monitoring compliance of pre-existing and planned industrial installations with the environmental laws set out by India's policy and law making community (Bowonder *et al.*, 1994). Initially founded on the backdrop of the Water Act of 1974 (with a specific agenda for water quality management), as more environmental legislations were put in place, these institutions gradually acquired additional responsibilities for monitoring compliance beyond the scope of water pollution, to include for instance a focus on toxins, corporate issues, and airborne pollution (Reich and Bowonder, 1992). More broadly, it is noted that there are over 200 Central and State statutes that have at least some relevance to environmental protection, and are therefore either directly or indirectly relevant to the functioning of the Boards (Divan and Rosencranz, 2001).

[30] The Water Act became the first real foundation for environmental protection in Indian law.

The environmental policy context has been further shaped by the 1984 Bhopal gas tragedy, which exposed internationally the inadequacies of the state machinery in the field of pollution control and triggered a renewed emphasis on central government in India's environmental affairs (Jasanoff, 1993). As a result, the MoEF, together with the Board and State Boards saw their regulatory powers being expanded. For instance, the Environment Act of 1986, which came into force soon after the Bhopal disaster, granted the central government authorities (namely the MoEF and the Board) the power to close down facilities not complying with environmental requirements, or to stop their supply of electricity, water and other essential services[31]. Another important legislation that followed the Bhopal accident was the 1987 Factories Act which authorised State Boards to demand risk information from hazardous facilities under construction, or to issue restraining orders against industries that were perceived as 'high risk' in terms of the likelihood of violating emissions standards (Jasanoff, 1993: 10).

Despite this wide set of regulatory and institutional reforms that have taken place in India, environmental conditions continue to deteriorate. Most of the rivers and other bodies of water in India are polluted, and large-scale deforestation is being carried out with impunity. With the additional pressures of urbanisation and population growth environmental degradation is becoming highly concentrated in cities and in the peripheries of large metropolises. Reich and Bowonder associate these changes with a widening gap between the 'intent' of environmental policy making in India and the actual 'achievement' of policy (Reich and Bowonder, 1992:643). This is a problem which is further compounded by what Sheila Jasanoff terms an 'insensitivity to feasibility' which consistently leads India's law makers to create new governmental obligations without providing the institutional infrastructure needed for their effective realisation (Jasanoff, 1993: 39).

The insensitivity to feasibility that Jasanoff has noted has over the years been subject to various interpretations. Furthermore, given the centrality of the Board and State Boards in the bureaucratic structure for implementing environmental laws, it is hardly a surprise that these institutions are often at the centre of discussions on implementation failure. Singh et.al., for instance, write: 'unfortunately these Boards have little success to justify

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[31] In 1988 this authority was used effectively to issue 43 notices of closure. (Bowonder *et al.*, 1994)

the responsibility reposed in them. The Boards are virtually defunct. Organisations or individuals in public interest file most environmental cases, but hardly ever does one see a case initiated by a Pollution Control Board' (Singh *et al*., 1993: 2). They further note that the Boards can sometimes work in support of polluters (such as industrial operators and corporations) in court as 'party respondents', as opposed to working with those individuals filing a case in the first place, thus rendering the overemphasis and 'total monopoly of power' vested in these Boards 'misplaced' (ibid: 2). Singh concludes that this is 'probably the most important reason for the failure of these Acts[32]' (ibid: 2).

Others commentators perceive the problem of poor implementation to be linked to a deeper conflict between an agenda of environmental protection and promoting growth in India. For instance, the liberalisation of India's economy since the mid-1990s has arguably accelerated growth; however this growth would not have been achieved without the state's active role in tilting the economy in favour of industry (Kohli, 2006, Williams and Mawdsley, 2006). India's annual growth rate has risen to 5.8 percent in the period of 1980-2004, and much of this growth is attributed to the increase in productivity of the industrial, mining and manufacturing sectors (Kohli, 2006:1365). As a result, the Congress Party, which has created most of India's environmental laws, has also had the 'ear' of the business lobby (especially the large scale business lobby) (Stuligross, 1999: 5), advocating the removal of 'unreasonable' constraints on the 'international' competitiveness of Indian industry(Jasanoff, 1993: 13). The fact that there is a coherent interest at the highest levels of government in keeping business booming no matter the environmental costs is in turn reflected domestically. For instance, in 1991 more than 4000 pollution cases [33] were pending around the country. Since then this figure has been constantly on the rise[34], while the rate of conviction has remained rather low irrespective of the growing number of legal cases currently being filed in court (CSE, 2009: 30).

Weak implementation of environmental norms is further complicated by the fact that despite legislative provisions that confer special powers to the Boards to impose

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[32] Referring to the environmental legislations put in place since the 1970s by India's law makers.
[33] The majority of which are filed against industries.
[34] It is hard to determine an aggregate nationwide figure based on current trends since there is high variation across the different states. But as an indication of the increasing trend of non-compliance, for the state of Madhya Pradesh alone, no less than 8,000 pollution cases are currently pending action by state courts (CSE, 2009).

sanctions on polluters, in practice it lacks real authority to deal directly with violating industrial units. This is partly a consequence of federalism in India. For instance, even though the Water Act provides that 'no person or firm can discharge sewage or effluents into a stream, well, sewer, or on land' without consent of the Boards, 'water' is ultimately a subject under the control of the state and not central government (Gazette of India, 1974: 15). As result the Board is often in no position to intervene directly and depends heavily on state authorities to enforce norms and regulations. The results in terms of policy implementation can therefore be surprising and vary hugely between different states. In Kanpur for example, which falls under the jurisdiction of the Uttar Pradesh Pollution Control Board, it appears that when pushed the pollution control board will selectively inspect and report the malfunctioning of some industrial units and use these reports to divert attention away from the many other effluent treatment plants lying idle inside industrial units (Alley, 2002: 174). Industrial operators that have made payoffs to the State Board, or are otherwise in favour with the Minister in power at the state level, are therefore in a position to manipulate the regulatory process and evade compliance with the Board's norms.

In theory the MoEF could step in in instances where State Boards are viewed as corrupt or too heavily influenced by state level political and industrial interests. However, this also seems to be a policy avenue that encounters significant barriers. This is partly because of the relative weakness of the MoEF to have any practical influence in bureaucratic struggles. This is particularly the case when environmental problems are likely to originate from policies implemented by other ministries, or indeed by the cabinet of the Prime Minister of India. For instance it is noted by Menon that the MoEF has played a key role in 're-engineering' the Environmental Impact Assessment (EIA) guidelines so that large infrastructure projects (initiated by other ministries) are given faster clearance (Menon and Kohli, 2008: 14). From the perspective of other ministries as well there is often little incentive to pay attention to the environmental consequences of their policies in light of the relatively ineffectual role of the MoEF. Arguably the current trend of economic liberalisation and deregulation of industry could further weaken the influence of the MoEF. Ineffective leadership on environmental matters by the MoEF is therefore another factor which poses a barrier to better implementation and strengthening of the functioning of the Boards, as their continued existence is closely tied to the MoEF in terms of both getting access to funds and executive support.

The problem of poor implementation is further confounded by the fact that the Board and State Boards are often over-bureaucratised and understaffed. This means that even without political interference it would be difficult for this set of institutions to perform to the required standards. The reasons behind this are several. Firstly, this is because the sources of pollution are simply too many and include both industrial and household wastes. In the state of Andhra Pradesh for example there are 700 large and medium sized factories and about 70,000 small-manufacturing units (Reich and Bowonder, 1992:652). Secondly, given that the Boards are often constrained by lack of resources, pollution control officials are often barely able to 'inspect' pollution levels at the point of discharge, and often tend to transfer a pollution case to the district or municipal authority. Thirdly, at the municipality level as well, enforcement of regulatory norms remains relatively inadequate and is often delayed further by arduous court struggles and far too many official and legal loopholes.

Another important challenge presented to these bureaucracies is linked to non-point sources of pollution, such as domestic wastewater sewage. This is a source of pollution that is increasing more rapidly because of growing population pressures, particularly in large cities and towns. Given the challenges posed to the Boards in terms of human and financial resources for monitoring industrial pollution alone, domestic sewage has become an area of concern which is largely left to the municipalities. As a result there is considerable variation both in the technological options adopted to control water pollution, as well as the public resources available to municipalities for pollution abatement. This makes it exceptionally difficult for the Boards to administer a command control approach model to dispersed sources of pollution in the same way as it monitors and controls industrial effluent.

Growing public distrust in the capacity of government agencies both at the centre and at the state level to implement environmental laws has led to an increasing number of activists and NGOs getting involved in shaping India's environmental governance. Some of the civil society initiatives have turned into social movements, the most popular being the Narmada Bachao Andolan (or Save the Narmada Movement) against the Narmada river valley project, which emerged from the grassroots to oppose the range of dam building programmes planned for the Narmada Valley. Since opposition to the Narmada river valley project began in 1985, civil society action has emerged in a

variety of forms, including marches, hunger strikes, barring officials from entering villages in the submergence zone and the threat to commit mass suicide by drowning (Williams and Mawdsley, 2006). These actions have been backed up outside the Narmada valley by pursuing legal challenges through the Supreme Court and a whole range of lobbying activities supported by international networks and NGOs.

Other civil society actions have been initiated and taken forward by individuals through public interest litigations (PILs) filed in courts (Divan and Rosencranz, 2001). The prominent litigator M.C. Mehta has become something of a folk hero, because he has single handedly pursued penal sanctions and closure of factories in violation of environmental norms. In M.C. Mehta vs. Union of India, popularly known as the Delhi Gas Leak Case, the Supreme Court sought to close and relocate Shriram caustic chlorine and sulphuric acid plants located in the 76-acre industrial complex in West Delhi. Other actions instigated by M.C. Mehta have taken up the issue of improving river water quality by pursuing lawsuits against polluting industries on the Ganga (Sathe, 2002). Because of a growing number of activists adopting the PIL route, the courts are increasingly seen to play a much more important role in environmental matters, often extending their realm of influence into fields traditionally left within the remit of the Board and State Boards, such as issuing directions to close down factories, enforcing interim directions as a measure to activate other executive authorities, cutting through bureaucratic gridlock, or by liberalising the scope of public interest litigation in a way that encourages citizens' groups and NGOs to take up an active stance in environmental affairs (Divan and Rosencranz, 2001).

The judicial and civil society route, however, also runs into a number of significant problems. In the case of the judiciary, litigation can be time consuming and there can be a large backlog of cases pending both in the High Courts of the states and the Supreme Court. Furthermore, prosecutors and courts may be reluctant to press criminal charges criminal against corporate managers and senior executives due to their social positions (Reich and Bowonder, 1992, Singh *et al.*, 1993). In the case of civil society, their energies tend to be scattered, often operating through rather dispersed networks which makes it difficult for more lasting and widespread reforms to take place through civil society influence alone. Another limitation is that those environmental issues that become NGO campaigns may not necessarily reflect a broader public interest but might

instead reflect the rather narrow interests of elite or middle class groups. For instance as discussed in section 1.1 on the drivers of urban change in Delhi, it is noted that it is very rare for city level NGO campaigns to include the environmental and social welfare of the poor as part of their mandates. This leads to generally lower visibility of peri-urban concerns, as opposed to Delhi environmental concerns, in the realms of both environmental litigation and environmental management.

These wider processes of change in the context of India's environmental policy have an impact on the functioning of the Board. In particular it becomes important to determine how this underlying political economy influences the actions of Board members. For instance, how are Board member priorities balanced across an overall objective to maintain the status quo, achieving a specific degree of improvement of environmental quality or preventing health damage caused from pollution? Given also the fact that multiple actors are increasingly more involved in policy negotiations ranging from the role of the Supreme Courts, NGOs and an increasingly more powerful industrial lobby. It is important to examine whose environmental priorities and values are better reflected in the Board's mandate. It has been argued that despite a growing public debate on environmental matters, major environmental policies are still adopted without public consultation, reflecting a strong adherence to secrecy within the Indian bureaucracy (Reich and Bowonder, 1992, Menon and Kohli, 2008). Based on a more critical evaluation of 'scientific' knowledge as constructed knowledge, the influence of personal judgment and values, in defining objectives for policy making and implementation are explored. These themes are examined with a specific focus on the Board's approach to water quality management, and with a particular focus on highlighting how the influence of Board members may pose barriers to the better articulation of peri-urban water quality concerns.

4.2. The Board's mandate and role in policy

The Water (Prevention and Control of Pollution) Act of 1974 marked an important milestone in environmental legislation in India as the first law for pollution control. It required 12 years of political negotiations and jurisdictional battles between the central and state governments for the law to be enacted (Dwivedi and Kishore, 1982). Following the enactment of the Water Act in 1974, the Board was expected to play a leading role in the abatement of water pollution with the overarching objective of addressing the 'maintenance and restoration of wholesomeness of water' in surface water bodies such as rivers, streams and lakes (Gazette of India, 1974). The same Act further stipulated an inventory of specific tasks and functions that the Board should perform which included 'promoting cleanliness of streams and wells', 'conducting investigations and research on water pollution', 'inspection of sewage and industrial effluent emissions, from installations and plants', and the 'laying down of standards' (ibid: 9). In more detail, the lists of functions as set out in the Water Act are:

- To advise the Central Government on any matter concerning the prevention and control of water pollution;
- co-ordinate the activities of the State Boards and resolve disputes among them;
- provide technical assistance and guidance to the State Boards, and to carry out and sponsor investigations and research relating to problems of water pollution and prevention, control or abatement of water pollution;
- plan and organise the training of persons engaged or to be engaged in programmes for the prevention, control or abatement of water pollution on such terms and conditions as the Central Board may specify;
- organise through mass media a comprehensive programme regarding the prevention and control of water pollution;
- collect, compile and publish technical and statistical data relating to water pollution and the measures devised for its effective prevention and control, and prepare manuals, codes or guides relating to treatment and disposal of sewage and trade effluents and disseminate information connected therewith;
- lay down, modify or annul, in consultation with the State Government concerned, the standards for a stream or well; and
- plan and cause to be executed a nation-wide programme for the prevention, control or abatement of water pollution

The above functions can be categorised as those that are 'advisory' and those which carry penal sanctions and are better described as 'regulatory'. The Pollution Assessment, Monitoring and Survey (PAMS) division takes up those functions that are related to pollution assessment[35] and relate more directly to the Board's advisory role. One important activity of PAMS is to coordinate the national water quality monitoring programme (henceforth referred to as "monitoring programme"). This was initiated by the Board in 1976 with 18 stations (i.e. for collecting water quality samples) on river Yamuna and has been gradually extended over time. In 1989, there were 324 and by 2001 784 monitoring stations (Goldar and Banerjee, 2004) including water sampling locations along rivers, lakes, canals, ponds, drains and groundwater. At present the monitoring programme comprises the greatest part of the Board's financial budget for pollution assessment[36] and comprises 1,429 monitoring stations distributed across 27 states and 6 union territories, envisaged to cover most Indian states and large cities (CPCB, 2009). The water quality monitoring programme therefore relates to the type of expert advice the Board can deliver on the water bodies and regions where policies for water quality restoration are required (monitoring practices are explored in detail in section 4.4).

Although in principle the Board is the central body for implementing environmental regulations, in practice regulatory functions are shared between the Board and the MoEF. On the one hand, the question of whether to grant environmental clearances to industrial and development projects and the coordination of EIAs is under the principal authority of the MoEF (2009), while on the other, the monitoring of pollution standards falls within the mandate and established formal roles of the Board. Part of the reason for this division of regulatory responsibilities is that the founding of the Board preceded the establishment of the MoEF. In recent years, however, the MoEF has grown and has become a more powerful regulatory and policy making body, taking more roles into its mandate. However, partly because of the Water Act (1974), the Board has remained in

[35] Subsequent to the Water Act of 1974 new legislations including the Air (Prevention and Control of Pollution) Act (1981) and the Environmental Protection Act (1986) have meant that additional pollution assessment responsibilities have been devolved to the Board in the areas of air quality, noise pollution and industrial planning. However, as the focus here is on water quality these other areas of the Board's pollution assessment activities are not discussed directly in this chapter.

[36] The second largest proportion of the allocated budget for pollution assessment is towards air quality monitoring. Together the national air quality monitoring programme and the water quality programme form the core pollution assessment activities of the Board.

existence, keeping the design and monitoring of pollution standards firmly under its own authority.

More specifically, the Board's regulatory functions are more clearly articulated for addressing industrial sources of pollution. The Pollution Control and Planning (PCP) unit, together with the Pollution Control Implementation (PCI) division, develops standards that carry specific limits for the discharge of pollutants into water bodies. The majority of these standards are associated with four categories of industries: petrochemical industries such as oil refineries, air polluting industries such as power plants, agro-based industries such as pulp and paper mills[37] and distilleries. Recently, PCI has also included in its mandate a division that deals with small scale industries such as tanning factories. Industrial units are expected to comply with the standards prescribed by the Board where specific penalties are imposed for non-compliance.

At the state level of governance, many of the Board's regulatory functions (i.e. in terms of ensuring compliance with regulatory norms) are devolved to the state pollution control boards (in short, State Boards) (Gazette of India, 1974) and from there are passed on to regional, district and city authorities. In the case of Union Territories[38], regulatory functions are transferred to pollution control committees (PCCs). This basic division of power between the 'centre' and 'state' follows the federal nature of the Indian constitution and aspires to a more decentralised system of environmental regulation (Goldar and Banerjee, 2004)[39]. In general, the Water Act envisages a cooperative relationship between the Board and the State Boards, where the Board maintains an advisory role to the State Boards (i.e. the design of industrial standards), while the implementation of the Water Act is considered a matter for the state (ibid).

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[37] Paper mills based on nonconventional agro residues (i.e. wheat straw, rice straw, and sugarcane bagasse) are being encouraged due to increased demand for paper and acute shortage of forest-based raw materials (Kumar *et al.*, 2012).

[38] A Union Territory is a sub-national administrative division in the federal framework of Indian governance. Unlike the states of India, which have their own elected governments, union territories are ruled directly by the federal government. Examples of union territories include Delhi, Chandigarh and Pondicherry (source: http://en.wikipedia.org/wiki/Union_Territory, last accessed 17/09/11).

[39] The reader is here reminded of the federal structure of governance in India, where the central government (or Union Government) is the governing authority of 7 union territories and 28 states (see also Figure 2).

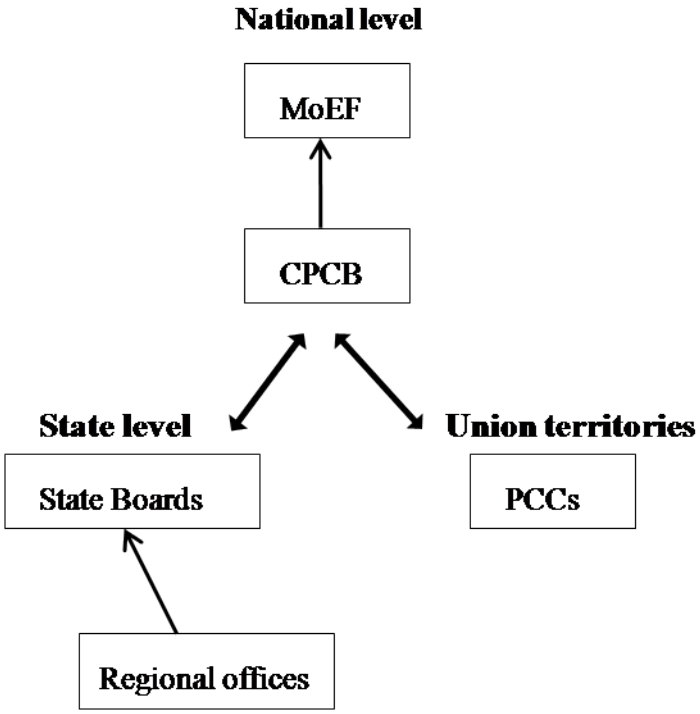

Figure 2: Institutional structure for pollution abatement in India

Curiously, because of the way the Board's functions have been stipulated in the Water Act (1974), it has accumulated powers to guide two very different types of processes. First, it administers a set of functions that relate to the 'assessment' of risks to health and the environment from water quality (this is closely linked to the Board's advisory roles). Second, it supervises those functions which relate to the 'management' of those risks (i.e. the Board's regulatory roles) (Jasanoff, 1987:211). Given the separation of policy advice and regulation in the science studies literature[40], it must be borne in mind that the Board has a hybrid role, providing policy advice on one hand, while also influencing the regulation of water quality. Thus it is not only a scientific advisory board, but one endowed with political decision-making powers and potential influence too. This duality in the Board's functioning and implementation of its advisory and regulatory roles can be perceived as intensely problematic given the competition of interests in the enactment of those two simultaneous roles.

[40] See for example Sheila Jasanoff's study of the US Environmental Protection Agency (Jasanoff, 1990).

Examples of this are provided in section 4.5.4 of this chapter and in Chapter 5, which describes how environmental NGOs and citizens have come to be increasingly sceptical of the Board's activities and consider that it is too easy for regulatory decisions to be influenced by industrial interests. The MoEF controls a substantial part of the Board's budget, and there is no precise mechanism for ensuring the Board's spending is 'independent' of the ministry's influence. This financial dependence jeopardises its capacity to take decisions without political interference (Lele *et al.*, 2010). (Section 4.4.4 explores how MoEF policy makers can affect decisions taken at the Board).

Another complication arises from the Board's current structure and this is perhaps less examined by the Board's critics: in practice, the delivery of its policy advisory and regulatory functions is not always straightforward and can be heavily influenced by the discretion of the Board members. This is demonstrated in section 4.4 of this chapter that discusses how water quality monitoring is defined and acted upon by Board members. It is also demonstrated in section 4.5 where it is argued that Board members in their professional position as 'regulators' become actively involved in the construction of 'regulation-rules in practice' (Fineman, 1998:953) in order to determine what risks from impaired water quality should be regulated more closely.

4.3. Participation of Board members

The way the Board executes its functions relates directly to the expertise of the Board members. In the case of the Board Chairman, Sub-clauses (1) and (2) of the Water Act state that 'a full time Chairman should possess special knowledge or practical experience of matters relating to environmental protection' (Gazette of India, 1974: 3). However, in the actual functioning of the Board, this clause is interpreted narrowly by its members in that 'special knowledge' is solely linked to 'scientific' expertise, and 'practical experience' is demonstrated by Board members having held additional government posts. Examples of this can be found in both tiers of management.

The first tier of management is made up of the Board of Directors. At this level the Board is composed of current and former bureaucrats, academics and representatives of the various central government ministries. The Board of Directors is led by the Board Chairman, Mr. Sinha, who has held senior government posts in the past (including that of Chairman of M.P. Pollution Control Board) and the Member Secretary, currently J.S.

Kamyotra. Amongst the Directors there is also a strong representation from the industrial and energy sectors, including the technical director of the National Thermal Power Cooperation, R.K. Jain, and the Joint Secretary of the Ministry of Mines, Ajita Pande. Except for the Chairman and the Member Secretary, who are employed full-time and share the bulk of responsibilities, the term of appointment for all other members cannot exceed three years. All appointments are decided by the government, which has complete control over the appointment of Board members (Gazette of India, 1974). Notably, at this level there is no-one who is not affiliated to the government: there are no representatives of local community groups or environmental organisations, for example.

The second tier of management involves the scientists who run the different divisions of the Board. At this level the appointment of Board members is hierarchical and based on a rank system. The posts held by individual scientists are normally dependent upon the residency period and designation, which are both measures of performance. Scientists are gradually upgraded from Grade B, which is a junior post, to Grade F, which is a very senior post in the organisation (CPCB, 2010). Once a scientist has completed a minimum residency period he can be promoted to a more senior post. The directors of the Board divisions (PAMS, PCI etc.) are normally scientists who have spent a significant length of time in the organisation. Therefore, although ultimate executive power rests with the Board of Directors (namely the Chairman and the Member Secretary), the appointment of scientists is the main avenue for the Board to source 'expert' advice.

The appointment of experts is based primarily on prior background in science and technology (ibid). The Board norms make it mandatory for scientists to have a bachelor's degree in engineering, technology or physical science, while a master's degree or doctorate in engineering and technology is preferred (ibid). There is no direct requirement, however, for members at this tier of management to have relevant ecological expertise or expertise that is more closely related to environment fields.

The current system for appointing Board members has led the Parliamentary Committee on Science & Technology, Environment & Forests to argue that the Board's ability to function independently has been critically undermined. For example in its 2008 report

on the functioning of the Board, it is stated that ‘with a composition dominated by bureaucrats and constituted by central government, the Board cannot be expected to act as a watchdog of environmental protection’ (Parliament of India, 2008: 5). The report further notes that ‘key posts of the Board are manned by officers of the Indian Administrative Service, who neither possess the necessary capabilities and expertise in properly managing pollution control activities, nor do they invest enough time to pay attention to these activities’ (ibid).

Despite the potency of the critiques coming from the Parliament, they do not take into consideration the role of scientists working within the organisation (that is, the second tier of the Board’s management). Does the appointment of scientists influence the Board’s capacity to function ‘independently’ and be truly representative of a broad range of interests? For specific pollution abatement priorities such as ‘water quality’, does a reliance on a particular kind of ‘science’ influence the types of expert advice the Board can deliver? Subsequent sections will attempt to shed some light on these issues. More importantly, in considering the Board’s practices, this study places more emphasis on understanding the types of ‘knowledge’ constructions that dominate a regulatory setting and, in particular, the influence Board scientists have on the dissemination of this knowledge.

4.4. Expert advice and policy practice: the case of water quality

Turning first to the Board’s role as an expert advisor, the type of advice the Board can deliver depends largely on how water quality problems are discussed by Board members in an organisational context. There is therefore an important discursive element to understanding how Board members convey their expert advice that is expressed through (i) the use of the Board’s definition of water quality, (ii) the scope of the Board’s water quality monitoring programme, (iii) the production of written texts (i.e. the Board’s annual achievements reports), and (iv) the influence of the policies themselves upon Board members.

4.4.1. Defining water quality: the role of the Designated Best Use (DBU) approach

The first point of departure is the definition of water quality adopted by the Board. As described earlier, the 1974 Water Act and the setting up of the Board and State Boards became the formal institutional machinery for addressing water quality. However, what was still lacking then was a clear strategy for achieving this goal in policy practice. Specifically, the definition of water quality used in the Water Act with its emphasis on maintaining and restoring the 'wholesomeness' of water was regarded as too 'broad' for the Board members to be able to design pollution abatement schemes[41]. It is of interest then how the Board scientists have influenced the adaptation of that definition to a discursive framework that has a direct relation to science.

A powerful conceptual tool which has emerged from the Board for planning water quality restoration is the Designated Best Use (DBU) framework (CPCB, 2002). According to the DBU, water quality restoration is organised on the basis of achieving a range of standards of water quality judged to be 'desirable' for human use. According to this concept water is prioritised into different 'classes' that encompass different water quality criteria. The highest water quality classification (Class A) is for drinking water sources and the lowest (Class E) for industrial, irrigation and waste disposal uses (see Table 2).

[41] Interview with Dr. Joshi, the former additional director of the Board, 23 November 2009.

Table 2: Use-based classification of surface waters, adapted from (CPCB, 2002)

Designated-Best-Use (DBU)	Class of water	Criteria
Drinking water source without conventional treatment but after disinfection	A	Total Coliforms Organism MPN/100ml shall be 50 or less pH between 6.5 and 8.5 Dissolved Oxygen 6mg/l or more Biochemical Oxygen Demand (20^{o}C), 2mg/l or less
Outdoor bathing (organised)	B	Total Coliforms Organism MPN/100ml shall be 500 or less pH between 6.5 and 8.5 Dissolved Oxygen 5mg/l or more Biochemical Oxygen Demand 5 days (20^{o}C), 3mg/l or less
Drinking water source after conventional treatment and disinfection	C	Total Coliforms Organism MPN/100ml shall be 5000 or less pH between 6 to 9 Dissolved Oxygen 4mg/l or more Biochemical Oxygen Demand, (20^{o}C), 3mg/l or less
Propagation of wildlife and fisheries	D	pH between 6.5 to 8.5 Dissolved Oxygen 4mg/l or more Free Ammonia (as N) 1.2 mg/l or less
Irrigation, industrial cooling, controlled waste disposal	E	pH between 6.0 to 8.5 Electrical Conductivity at 25^{o}C micro mhos/cm Max.2250 Sodium absorption Ratio Max. 26 Boron Max. 2mg/l

The definition of water quality following the DBU approach strongly influences the type of expert advice Board members perceive they can deliver. In the first instance, the DBU framework influences the type of water uses that are of 'scientific' interest to Board members. The Board's role in this case is tied to the monitoring of existing water quality trends at a national level and whether water uses identified under the DBU can be met in policy practice through the implementation of water quality restoration programmes. The objective of the DBU has been to plan pollution control activities in a way that is not 'cost-prohibitive' and does not significantly 'deter' development activities (CPCB, 2008). However, implementing the DBU also carries assumptions about the criteria for the framing of 'credible' sources of information, as well as for the choice of 'suitable' scales of assessment that in practice may not be appropriate for addressing complex water quality concerns affecting peri-urban areas.

This is firstly related to the language adopted for describing water quality. From the Board's perspective, water quality is evaluated against pre-described parameters such as Biochemical Oxygen Demand (BOD), pH and dissolved oxygen (CPCB, 2008). However, such a narrow technical definition of water quality fails to recognise the different meanings that water users attach to problems of water quality. For instance, insights from the peri-urban case study explored in detail in Chapter 5 suggest that water quality is evaluated by poorer citizens on the basis of their own criteria, such as aesthetic considerations (colour and appearance), and far less on the basis of formally prescribed physico-chemical parameters. These more subjective interpretations emanating from water users not only propose a more complex account of the local impact of worsening levels of water quality, but also tend to expose the seriousness of protecting the quality of water used for purposes that are not taken into account in the DBU definition.

Another implication of the DBU approach is that the avenues for channelling expert advice are, at their core, sector-derived, which makes it difficult to integrate water quality priorities that are not represented in the DBU definition. More importantly the link between water and environmental quality has not been given sufficient emphasis in the DBU classification. Because of this omission, pollution abatement measures to address deteriorating water quality focus selectively on those water bodies which there is a strong incentive to protect for direct beneficial uses. Smaller water bodies, or those with no significant water-use, are therefore excluded following the DBU classification. This explains why there have been many comprehensive water quality studies on the river Yamuna[42], while for river Hindon (a smaller river located in Ghaziabad district) there is almost no water quality data available (Suthar, 2009). It also explains why the water quality of the river in the peri-urban case study is so poor that is often described as a 'drain', in spite of the fact that it is used for different purposes including bathing and local religious ceremonies (ibid).

Finally, the use of the DBU reflects the Board's efforts to focus attention more closely on the 'science' of water quality and away from the politics. More importantly, addressing water quality involves political questions that do not figure prominently in the Board's discourse. Section 4.4.3 of this chapter explores how written reports and the

[42] Such as the 2006 report on the *'Water Quality Status of River Yamuna'* (CPCB, 2006).

presentation of findings encourage an 'apolitical' view of water quality protection. A fairly 'apolitical' representation of contemporary water quality problems and their solutions is also verified by the relationships that are formed between the Board and other powerful institutions. In particular, section 4.4.4 explores how the more powerful MoEF can influence decisions in important ways, such as the type of expert advice the Board can deliver. Examples include the MoEF's control over the implementation of river action plans, including the Ganga Action Plan (GAP) and the Yamuna Action Plan, thus influencing the ambit of the monitoring strategies and the process of prioritising limited organisational resources for pollution assessment.

4.4.2. Trust in numbers: the practice of water quality monitoring

On the basis of the DBU definition of water quality, the Board has devised a national water quality monitoring programme. The Board's monitoring programme is largely framed as a scientific research exercise that fits well within the Board's advisory role. But it also occupies a central role in the Board's discourse that is worthy of more focused attention because it carries a number of assumptions regarding the robustness of the monitoring criteria, decisions on the type of scale which is appropriate for monitoring and the type of information it aims to deliver. For example, the Board decides whether information can be 'quantitatively' represented according to the selected criteria identified in the monitoring programme. Although the heavy emphasis on the 'numerical' measurement of water quality appears obvious to the scientists working for the Board, it needs to be examined for the particular rhetorical functions that it serves.

Porter (1995) proposes a more cautious examination of the use of numbers in expert advisory systems. He argues that quantitative methods do not simply reflect the technical requirements of researching complex subjects; they also have an important role to play in protecting experts against charges of 'indeterminacy' and 'subjectivity'. More so in the case of the Board with its regulatory functions that necessitate the production of an image of authority and of control over the evidence used to inform decision-making. Quantification further offers a framework which is both rigid (i.e.in that it refers only to numerical information) and highly standardised (presenting monitoring criteria as a legitimate tool for decision-making), and which can be used to cultivate trust in scientific organisations in the light of sceptical critics (Jasanoff and

Wynne, 1997, Hilgartner, 2000). In this context the Board's overriding interest is to delineate a space of professional authority that is credible, that distinguishes the function of the Board from that of other stakeholders such as environmental lobbying organisations, and that can also stand up against potential conflicts with political groups and opposing interests. However, what is at stake is the disclosure of a number of uncertainties and inherent subjectivities associated with the monitoring process by claiming the support of science.

Such considerations are seen to play a significant role in how scientists relate to the practice of monitoring. Firstly, water quality criteria play an important role in legitimising the Board's claim of objectivity. Because water quality information is organised in terms of the agreed criteria defined in the monitoring programmes, it is assumed that the need for scientists to take their own stance or employ their individual judgment is eliminated. As one senior scientist in charge of the Board water quality testing laboratory said, 'In order to assess the water quality of the rivers we measure BOD, DO (dissolved oxygen), TDS (total dissolved solids), and pH'[43]. These measures 'give us a good picture of whether the class of the water body should be A, B, C, or D'[5]. Because these criteria are evaluated using scientific norms, the validity of relying solely on the Board's predefined criteria in order to justify policy decisions is rarely questioned.

An emphasis on numbers is also important in cultivating trust in the Board's role as an expert advisory body on pollution prevention. Scientists have significant symbolic pride and a sense of 'being in control' of expert knowledge because of a perceived superiority in the handling of numerical information. A senior scientist leading the Board's monitoring programme described this: 'Our power is that we have the data, people come to us for information'[44]. The superiority of the Board as 'information keepers' is further strengthened by a sense of prestige attached to the processing of numbers. A scientist working in PAMS division said, 'Monitoring is a truly difficult task; the Board needs to keep track of more than 1,400 observation points across the whole country, and this

[43] Interview with Dr. Verma, senior scientist of the Board laboratory**,** 22 November 2009.
[44] Interview with Dr. Desai, senior scientist of the PAMS division, 13 November 2009.

requires a huge investment from us both intellectually and in terms of time and resources'[45].

Numbers are equally important for separating the Board's expertise from that of different stakeholders such as those working for State Boards and environmental NGOs who are perceived not to have the same disciplinary background and specialisation. The Board's *Water Quality Monitoring Guidelines* report highlights that 'the optimum situation is when the entire monitoring procedure, from sampling to final analysis, is within the hands of one group of experts' (CPCB, 2008: 19). This framing of the monitoring process lays down the Board's professional boundaries in important ways. For instance, there is an assumption that it is hard for Board scientists to trust pollution enforcement agencies to do the same type of numerical work that the Board does because they do not have the same level of experience in technical matters. Referring to the role of the State Boards, a Board environmental engineer said 'State Boards can give us a distorted account of the problems so that is why we usually rely on our own data for producing the reports'[46]. At the same time, attributing a sense of powerlessness to non-governmental organisations that do not possess the same type of specialisation in monitoring, a senior member said, 'The Board cannot rely on NGOs for monitoring water quality; their role is much more about creating awareness'[47]. In this way Board members are in a position to defend monitoring as an 'internally' managed operation, significantly restricting how far different interest groups can influence the water quality assessment process.

This is the dominant view of the monitoring process adopted by Board members. But how representative is it of the local realities of worsening levels of water quality impacting local contexts? An important area of contestation between the technical view and the local implications of impaired water quality is exemplified by the large discrepancies between the desired permissible limits and the higher values often recorded in monitoring stations. Senior scientists from the PAMS division attributed this to the fact that the water quality criteria had not been compiled with a view to addressing local conditions[48]. Board members also agree that when the water quality

[45] Interview with Dr. Bhatt, senior scientist, PAMS division, 10 November 2009.
[46] Interview with Mr. Raj Kumar, environmental engineer, PCI division, 22 December 2009.
[47] Interview with Dr. Modi, senior scientist PAMS division, 6 December 2010.
[48] Interview with Dr. Rao, senior chemist and additional director, 15 November, 2009.

criteria were put in place, they were perceived primarily as a 'desk-based' exercise dictated by the 'international literature', and not by 'baseline studies'[49] which might have encouraged prescribed parameters to be more responsive to local conditions. Because, as a Board member claimed, 'things are moving ahead based on experiences from abroad'[50, 51], the water quality criteria recommended by the Board are often too stringent to be implemented in the Indian context. Peri-urban areas are representative of the contradictions which arise when attempting to implement the water quality criteria prescribed under the Board's water quality evaluation framework. BOD, an indicator of organic pollution load which is central to the Board's monitoring programme, has to a recommended limit of 3 mg/l for water used for bathing purposes under the DBU (see Table 2). However, when predefined parameters such as BOD are monitored outside the Board's institutional framework, their value is questionable because observable values commonly far exceed the limits recommended by the Board. This may well be the case in local situations where criteria are often not met. In the peri-urban case study an environmental NGO's own assessment of the Kali river, a tributary of the Hindon river, denotes observable values of BOD that are in fact much closer to 1000 mg/l, a level at which the river is entirely devoid of oxygen! (Lewis, 2007). Under conditions of over-abstraction of water for industrial and agricultural uses, meeting this target becomes even more problematic because there is little fresh water to dilute the excess organic pollution load.

Part of the reason why such quantitative rules remain dominant despite their ambiguities is that they often carry assumptions that are validated through science. From the perspective of an IIT engineer who is more sceptical about the 3 mg/l limit prescribed in the DBU, it can be argued that this is based on the 'outdated' assumption that rivers can autonomously lower the level of BOD without pollution control interventions due to their self-purifying properties[52]. Nonetheless, the fact that this argument is 'outdated' does not mean that it is not supported through local level regulatory practices. The majority of the water quality targets set by the Board are still referred to by pollution

[49] Studies defined as those that consider the specific country where water quality criteria are being applied.
[50] Interview with Dr. Modi senior scientist, PAMS division, 1 January 2010.
[51] Referring to the WHO '*Guidelines for drinking-water quality*' (WHO, 2008).
[52] Interview with Mr. Ajay Prasad, an environmental engineer from IIT, New Delhi.

control authorities despite the inherent difficulties and ambiguities they face when attempting to meet these targets in practice.

To some extent, recognition of these contradictions necessitates a shift away from the DBU classification which, despite its inherent limitations, continues to have such a marked influence on the Board's approach to water quality management. Many scientists who are familiar with the work of the Board have expressed this view. The former director of the Pollution Assessment Division, Dr. Joshi, argues that one of the reasons why monitoring programmes continue to fail is because 'the DBU concept only focuses on the direct utilisation of water by human beings, when today it is generally acknowledged that even the survival of life itself may depend on the health of the environment and ecology as whole'[53]. But how ready is the Board to face this challenge? And does it possess the necessary expertise and resources to do so? Board members are often sceptical amongst themselves about the ability of pollution enforcement institutions to effect this transition. According to Dr. Verma, leading the Bio-science and Instrumentation Laboratory, 'we are only in the early stages of using novel approaches such as biomonitoring for instance, and these are piloted only in a few locations across the country'[54]. Another noteworthy concern raised by Board members about bringing to scale alternative monitoring techniques is the technical capacity constraints of the State Boards. The Board members tend to agree that State Boards are in a position to 'conduct basic measurements but for more elaborate monitoring techniques, water samples for analysis should be sent directly to the Board'[55]. However, even though the Board has greater 'in-house' expertise, it too is constrained by its own limited resources and manpower, which in practice means that, for non-conventional measurements, it prioritises only a limited number tests every year (CPCB, 2009).

The above discussion demonstrates that scientists can often present fairly biased opinions on a number of critical issues which are relevant to water quality monitoring. Most importantly, there is general agreement that some of the Board's monitoring approaches may be inadequate for responding to current water quality challenges. For instance, some of the key scientists, such as Dr. Joshi, affirm that the DBU classification may offer little scope for evaluating water quality beyond the range of a

[53] Interview with Dr. Joshi, former additional director of the Board, 23 November 2009.
[54] Interview with Dr. Verma senior scientist of the Board laboratory**,** 22 November 2009.
[55] Ibid.

prescribed set of standards. However, what is surprising is that Board scientists do not perceive that other stakeholders, beyond the remit of the Board, could have a more meaningful influence over water quality monitoring processes. For instance, the fact that the role of environmental NGOs was perceived solely in terms of creating public 'environmental awareness' was partly because some scientists feared that a more meaningful involvement of NGOs in the knowledge creation process could potentially damage the credibility of the Board. This could occur, for instance, if NGOs were to start providing information on sources of pollution that contradicted the assessments of the Board, or information that in the Board's opinion carried management implications not directly linked to its own mandate (e.g. the human health effects of industrial pollutants).

4.4.3. Water quality information in the public domain: the logic of official reports

The previous section demonstrated how information is communicated 'internally' amongst Board members. However, the type of expert advice the Board puts forward can also be interpreted through the way water quality information is communicated 'outwards' to non-experts. As Hilgartner argues in his study of the United States National Academy of Science, official reports are often crucial for expert advisors to produce 'credible' knowledge by controlling the enclosure and disclosure of information (Hilgartner, 2000: 20). These experts reveal information to their intended audience and place it on public display, but also actively conceal valuable information by simply omitting it from the reports (ibid: 17). Based on these insights, the Board's reports should be interpreted not only on the basis of the water quality information that they usually reveal and how this information is presented, but also for their complete exclusion of specific problems and concerns from the realms of policy.

Particularly central to the Board's efforts to communicate information to a wider audience is the production of annual reports. When the Board was founded, annual reports were short and lacking in detail. However, with the expansion of the Board's mandate and resources, these reports have developed in terms of length (on average 300 pages) and the range of topics covered. They outline the progress made in specific studies conducted by the Board over the year, the prosecutions set in motion against polluting units, and the orders for closure of specific industrial units as well as the financial aspects of the Board's functioning (CPCB, 2009).

The nature of these reports is to summarise the Board's activities on a yearly basis and to 'showcase' the organisation's main achievements over the preceding year. Annual reports are more widely circulated than other reports compiled by the Board. They are available both via the Board website and in hard copy and are read by a number of stakeholders including researchers, environmental NGOs, students, industrialists and State Board officials. Thus the production and distribution of scientific information through annual reports can be understood as a central 'out-reach' strategy of the Board that has wider implications for the nature of water quality information than the scientists might anticipate, in that they are communicating with a larger audience. The following insights are drawn from the report of 2008-2009, which has been selected for closer scrutiny because it represents a more recent example of the Board's report-writing and range of organisational activities.

Water quality is dealt with most comprehensively in chapter 5, 'Air and Water Quality Monitoring Network' (CPCB, 2009). As the title suggests, the aim of this chapter is to outline the main research findings by drawing from the Board's monitoring programmes. It is in the interest of the Board therefore, to convince its readers not only that the information provided is credible (produced with the support of expert knowledge) but also that it provides a representative basis for wider consultation. In order to achieve these objectives, the writing style, the use of specific terminologies and the overall presentation of the findings become central ingredients in producing a convincing narrative.

Drawing attention to the robustness of the scientific rationale employed to compile the information is an important strategy for building trust in the report findings that follow. Again, numbers play an important role. When referring to the monitoring 'network', which includes '1,429' stations in '27' states and '6' union territories, the reader is left with little doubt that the assessment has covered a wide geographical area including a range of water bodies (CPCB, 2009, p. 13). The table entitled 'River Basin Distribution of Water Quality Monitoring Stations' which includes the list of names of water bodies, as well as the numbers of monitoring stations set up for each water body, serves to demonstrate the robustness of the programme. In the same text, there are also several references to monitoring parameters included in the assessment: 'Water samples analysed for 28 parameters consisting of physico-chemical and bacteriological

parameters' and '9 trace metals parameters' and '28 pesticide residues', and 'Biomonitoring in specific locations' (ibid: 16). By emphasising the monitoring *stations* and the *parameters* in an interchangeable way, the Board is able to justify its water quality assessment rationale, as well as the findings that emerge as a result of this approach.

Another important aspect of the report writing strategy is the presentation of the main findings, which becomes more apparent as one proceeds through the Board's report. The water quality findings are conveyed with the support of figures and therefore deserve more attention with regard to the report write-up. The use of figures aims to summarise water quality trends across the whole range of water bodies and involves a combination of statistical analysis and graphical interpretation of numerical data. At first reading, these figures seem to be a fairly routine way of communicating scientific information. On closer inspection, however, the figures aim to justify how the reports make the significance of certain water quality trends appear self-evident to the reader, while completely omitting others. These omissions are not random; on the contrary they are an integral element in writing the report (Hilgartner, 2000: 53).

Figure 3, which describes the water quality of the river Ganga, illustrates some of these concerns. This, and similar figures in the same report, commonly draw the reader's attention to water quality trends that are apparent on fairly large scales. For example, it refers to the level of a river basin (the Ganga Basin), the state (Uttaranchal) and the city (i.e. cities that are located within the state or the river basin), without telling us much about water quality trends that occur on smaller scales. Focusing on the city or the district levels for example reveals a much more diverse range of water quality scenarios. Some of this diversity is scarcely addressed; for example in the case of air quality monitoring, where the report distinguishes between different air quality trends in 'industrial' and 'residential' areas (CPCB, 2009: 34). However, these and related figures remain rather silent as to the patterns that form amongst different types of settlements. Indeed, the peri-urban scenario illustrates that poor colonies are often far more exposed to deteriorating water quality than middle class and more affluent colonies (see also Chapter 5).

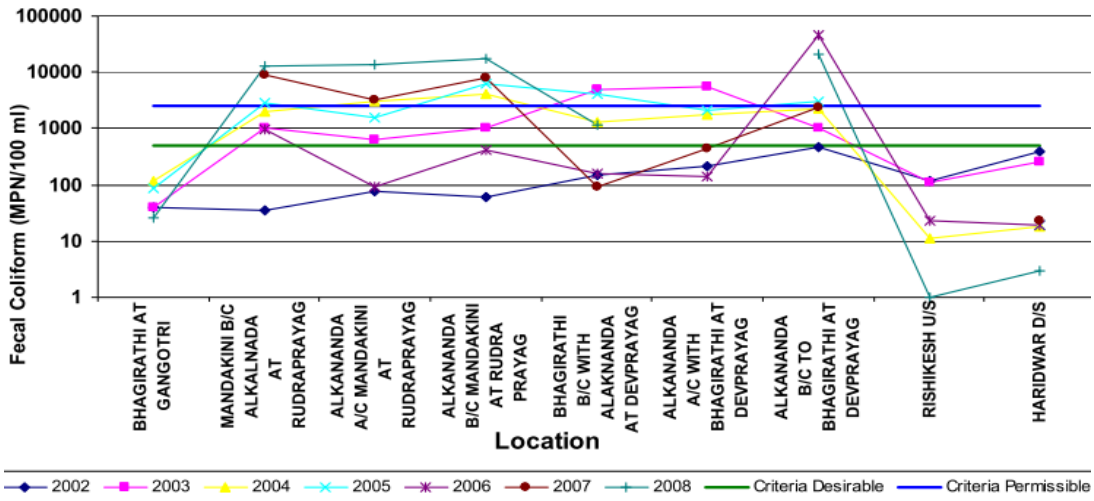

Figure 3: Water Quality of river Ganga (Uttaranchal Segment)

Figures can be further understood as discursive devices for reinforcing a bias in the public domain towards river basin issues in the assessment of water quality. River basin issues are central to the design of the monitoring programme, but also to the type of information scientists share amongst themselves. As a senior member of the Board said, 'our job is to monitor rivers, slums are not our responsibility'[56]. This logic, which is reproduced in the Board report, implies that monitoring is linked to the 'biophysical' environment and distracts the reader's attention from specific places where people are in direct contact with poor-quality water. Another limitation of this logic is that it directs attention to the river Ganga and the river Yamuna. However, the extra emphasis on these two rivers is not accidental. Large-scale policy initiatives such as the GAP and YAP and broader socio-economic factors have influenced scientific priorities for designing monitoring strategies and for selecting appropriate levels and sites of interest (for more details see next section 4.4.4).

[56] Interview with Dr. Desai, senior scientist, PAMS division of the Board, 13 November 2009.

Another important function served by the report is to protect the authority of the Board from being undermined in light of its findings. This necessitates the production of a certain kind of argument to describe water quality trends that appear in the figures, and that guide the reader down specific logical channels (Hilgartner, 2000: 9). It is noted in the Board's description of the national water quality trend that:

> *The water quality monitoring results obtained between years 1995 to 2008 indicate that the organic and bacterial contamination are continued to be critical in water bodies. This is mainly due to discharge of 'domestic wastewater' mostly in untreated form from the urban centres of the country. The 'municipal corporations' (emphasis added) at large are not able to treat the increasing load of municipal sewage because of which sewage may flow into the water bodies without treatment. Secondly the receiving water bodies also do not have adequate water for dilution, therefore, the oxygen demand and bacterial pollution is consistently increasing and may be the cause of water borne diseases (CPCB, 2009: 16).*

This argument constrains in a number of ways what the reader can learn about water quality. The reader is encouraged to assume that organic and bacterial sources of pollution attributed to *domestic* wastewater are the sole causes for deteriorating water quality. The statement also makes it very clear that the 'blame' for these sources is attributed to *municipal corporations*. However, the same statement does not provide any details about industrial sources of pollution and their contribution to water quality problems. Industrial regulation is an area that is conventionally attached to the Board but is likely to be controversial, and it is not in the interest of the Board to disclose sensitive information to the public. Another implication that can be drawn from the report is that it tries to convince the reader that the Board has fulfilled its roles by providing a fairly dense 'technical' description of a specific set of water quality issues and concerns. However, one could argue that the 'regulatory' responsibilities of the Board that seem to emanate directly from these findings are deliberately left ambiguous. In this way, and through the support of the annual report, the Board is in a position to convince its audience of its institutional authority as a monitoring body, without allowing its credibility as a regulator to be undermined.

4.4.4. Policy processes influencing the Board's advisory roles

So far the interest has been mainly centred on the role of scientists influencing policy and research priorities for water quality. However, a better understanding of the Board's functions would be incomplete without some discussion about how policy processes influence the Board members. As previous sections in this chapter have shown, the Board is more likely to place emphasis on the 'science' of water quality. However, this underplays how its policy advisory mandate is affected by a wider political economy comprising powerful institutions, political interest groups, and heavily-funded policy programmes.

In the first place, the role of the Board has become increasingly political, partly because it is positioned institutionally below the MoEF. The Water Act, 1974, states that the Board is under obligation to 'sponsor' research relating to water quality, and to 'advise' the central government accordingly. But these statements assign more power to the Board on paper than in actual practice. For instance, the MoEF is the most important source of funds for the Board and also has considerable leverage over its research agenda (CAG, 1992, p. 64). Board members perceive this to be true as well. For instance, many senior Board members saw the role of their institution as more about 'assisting' the MoEF by operating as its 'technical arm', rather than leading decision-making on pollution matters[57]. Even though the Water Act previously conceived of the Board as a leader in environmental protection, this role now appears to have been taken over by a more powerful environment ministry. However, the implication of this for the Board's function has not been addressed formally in policy, putting the Board in a delicate position where it needs to uphold its claim to operate 'independently', while in practice being largely dependent on the MoEF for its functioning (CAG, 1992).

Within this broader policy environment the control that the MoEF exerts over the Board's monitoring programmes is equally relevant, yet it can be less obvious. As river pollution in the Indian context has always been high on the policy agenda (even though the policies have not yet delivered real improvements in the quality of major rivers), the government tends to put pressure on the Board members to develop monitoring strategies that have a river-related focus. As one of the scientists emphasised, 'our

[57] Interview with Dr. Desai, senior scientist of the PAMS division, 20 November 2009.

expertise is sought by the MoEF to monitor rivers; other aspects are dealt with by departments in the ministry'[14]. But there is also a focus that prioritises certain rivers over others due to their cultural and religious significance. Another scientist pointed out that 'the Yamuna and the Ganges are considered 'holy rivers' and that makes them a priority for the Board' [58], suggesting that such priorities are often seen to be imposed by policy influences, and not based on 'scientific' considerations alone.

Secondly, in some instances water quality tends to count for more in certain contexts than in others. This has been expressed by an environmental activist as follows: 'Delhi has always been more important for the Board because of pressure being placed upon it by the Ministry, the Supreme Court and civil society lobbies'[59]. The preference for Delhi in monitoring programmes can be attributed both to Delhi being the capital and to powerful institutions often exercising considerable pressure on the Board members to focus their activities on the context of Delhi. National spending as part of the river action plans also reflects this bias with more than 71 percent of YAP money being spent in the neighbouring towns of Delhi, Ghaziabad, Agra, Faridabad, Panipat and Yamunanagar (CSE, 2007). The involvement of Board members can be at times hard to justify, especially when Delhi has its very own pollution control authority – the Delhi Pollution Control Committee. According to Dr. Rao, a Board chemist in charge of the water laboratory, the reason why the Board has invested so much in Delhi is firstly because the headquarters of the Board are situated in the capital, but also because focusing on Delhi helps consolidate the Board's image as a technical and pollution control authority. As he said, 'We [the Board] want to be the model for others [implying State Boards and local authorities], so we have made a model of Delhi'[60].

This emphasis on the capital (and a city centric view of water quality problems) of course undermines the water quality concerns of neighbouring districts. This is part of the reason why Board scientists do not acknowledge polluting factories that have been closed in Delhi and subsequently relocated illegally to neighbouring peri-urban areas, even though, strictly speaking, these units still fall within the boundaries of the NCR of Delhi. It also partly explains why in Delhi the monitoring programme is more

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[58] Interview with Dr. Patel, additional director of the Board, 22 November 2009.
[59] Interview with Leo Saldanha, director of the Environment Support Group based in Bangalore, 17th November 2009.
[60] Interview with Dr. Rao, senior chemist and additional director, 15 November, 2009.

comprehensive since it includes biomonitoring and heavy metals assessments and is conducted more regularly than in the neighbouring districts[61]. This implied favouritism towards Delhi has emerged as a result of a mixture of institutional influences, including the Board itself, the role of the MoEF, city level authorities such as Delhi Government, and the judiciary.

Thirdly, the Board does not operate independently, but instead as part of a combination of institutions that limits the influence of the Board on river-basin issues. This is regarded as an area of expertise traditionally assigned to the Board. The foundation of the National River Conservation Directorate (NRCD) and more recently the National Ganga River Basin Authority (NGRBA) jointly took on most of the authority for the coordination and planning of river pollution abatement schemes, including those where there has been considerable involvement of foreign engineering consultancy groups in collaboration with development banks[62]. These major changes in the way water quality restoration programmes are administered have restricted the Board's advisory roles to monitoring only certain regions, while private domestic and foreign firms largely supervise the implementation of the programmes.

[61] Interview with Dr. Rao, senior chemist and additional director, 15 November, 2009.
[62] The Government of India is receiving financial assistance by the Japan Bank for International Cooperation for the Yamuna Action Plan, while the coordination of the programme is led by Tokyo Engineering Consultants (TEC), a Japan based engineering consultancy firm (TEC, 2002).

4.5. Tracing the contours of regulation: official rhetoric and policy practice

Previous sections have attempted to illustrate how Board members communicate expert advice through the use of language, terminology and the orchestration of its monitoring programmes. The following sections discuss water quality as an 'administrative' creation (Hawkins, 1984: 23) that finds practical expression through a combination of environmental laws, pollution control standards, industrial consents of operation, and enforcement agencies operating at various levels (ibid). The Board's regulatory boundaries are mapped out through a series of narratives.

4.5.1. Deteriorating water quality: a consequence of implementation failure

Deteriorating levels of water quality are captured by a widely held view of 'implementation failure' amongst Board members. This narrative suggests worsening water quality is a consequence of a perceived weakness in implementation. Improvements in water quality are thus perceived to emanate almost entirely from higher financial investments in pollution abatement programmes.

A main argument in support of this narrative suggests that regulatory efforts are being hampered by overpopulation. Overpopulation implies that regulatory efforts are very rapidly becoming an unrewarding bureaucratic endeavour because of human-driven pollution (principally domestic sewage pollution). Amongst Board members, this argument tends also to associate deteriorating water quality with a frequently cited 'nuisance' amongst officials, referred to as 'urbanisation'[63]. What is often insinuated is that sprawling urbanisation is often the sole cause for the deterioration of water quality and solutions to deteriorating water quality are therefore considered to lie in areas that are not within the Board's own authority. Highlighting the importance of 'regionalisation'[20] and imposing controls on population growth as important strategies to improve water quality. However, focusing the problem and its solutions around escalating population growth and urbanisation in this way has a cumulative effect of removing the role of the regulator from the obvious shortfalls in pollution enforcement. This is an important reason why Dr. Patel, the additional director of the Board, claims

[63] Interview with Dr. Desai, senior scientist of the PAMS division, 10 November 2009.

that regulatory institutions are 'strong on paper, but weak in the field'[64], giving emphasis to the distance created between the legislative framework and the Board members.

There were other reasons too why implementation was considered weak, reasons linked more closely to the way the regulatory mandate is shared between the Board and State Boards. Partly because the Board is established in the background of the subject of water (water quality falls within the same definition) which is constitutionally addressed at the 'state' level, powers to implement policies rest fundamentally at the state level (Parliament of India, 2008: 7). Board members referred to this legislative provision on several occasions as a means of defending the Board against charges of poor enforcement of water quality standards. In an interview referring to the deterioration of water quality in Ghaziabad (i.e. the peri-urban case study), a Board member said 'we take good faith that the State Boards will regulate' it[65].

The most obvious shortcoming of this view of implementation, is that it presumes a fairly 'robust' regulatory structure operating at the local level. Chapter 5 provides empirical evidence that this is often not the case. Pollution inspectors, constrained by resources and manpower, tend to conduct only very basic assessments of water quality based on a limited set of 'physico-chemical' parameters. And also because State Boards are found lacking in sufficient executive power to close down polluting factories, regulatory targets are seldom met.

Although it is true that important regulatory powers do essentially rest with the State Boards, the way in which implementation failure is framed by the scientists means that they tend have little inclination to seek local level involvement. It assumes for instance a 'top-down' engagement with State Boards, whereby scientists facilitate technical advice at the local level but limit the potential for local sources of information to feed into the activities of the Board with the same ease. It also questions the institutional architecture of pollution regulation as it is conceived through the simultaneous existence of two Boards, one at the centre and one at the state level, and their ability to work in harmony together. A government audit of the Board and State Boards mentions that 'if

[64] Interview with Dr. Patel, additional director, 25 November 2009.
[65] Interview with Dr. Verma senior scientist of the Board laboratory**,** 22 November 2009.

the creation of the Board and State Boards is seen in the present day context, where pollution has started posing numerous challenges, it appears that the very foundation on which they have been established is shaky and weak' (Parliament of India, 2008: 6). Other criticisms find State Boards in particular to be highly unresponsive to the present complexity of environmental problems, possessing limited resources and manpower for ensuring compliance with various environmental regulations (CAG, 1992). The fact that important pollution sources linked to industries in peri-urban Delhi have still not been contained several years since the setting-up of the Boards, illustrates the cumulative effect of the role of the Board being detached from its own regulatory commitments. This is addressed in more detail in section 5.2.1 of chapter 5, which discusses the weakening authority of the regional office UPPCB in enforcing pollution norms in peri-urban Ghaziabad.

A more fundamental problem of framing deteriorating water quality purely as a consequence of 'implementation failure' is the oversimplification of the complex politics that tend to shape regulatory decisions. In some cases, industrial firms often have little concern about the environmental consequences of siting decisions, or about retrofitting old technologies as a strategy to minimise their pollution abatement costs. In the peri-urban context, this appears to be particularly the case with small-scale industrial units that have not taken any major initiatives for the control of pollution problems inside or outside the units of operations. As explained by pollution control authorities and officials interviewed in the peri-urban case study, the fact that 'some' industrial units can avoid penal sanctions often has less to do with administrative barriers, and more to do with political factors. For instance, political connections between the State of Lucknow and the district of Ghaziabad mean that pollution control officials may be pressured to withdraw or 'ease' penal sanctions on polluting industries (see also section 5.2.1). It is important to consider therefore that while a narrative of 'implementation failure' appears to appeal to Board members, it can also serve as a discursive strategy to conceal the type of politics which tend to dominate regulatory decisions at a regional and local level.

4.5.2. Policy implications of standard-setting procedures

Scientists perceive the subject of water quality as demanding a high degree of technical competence. This was initially illustrated in the Board members' perception of their 'advisory' roles discussed in section 4.4. Enforcement of 'standards' equally involves 'science', but because it is often attached to 'legal' requirements (i.e. emission standards are enforceable by law), the problematic role of the Board as both policy advisor and regulator becomes more pronounced. This prompts scientists to apply their expertise to prescribing specific temperatures, pollution amounts, and the kinds of polluting sources that are liable to penal sanctions (Hawkins, 1984).

For Board members, standard setting then becomes a powerful device for advancing particular views about the scope of regulation. In the first instance, standards operate as a reference point for scientists to propagate a 'technical' view of the regulatory process. This is supported through mobilising various arguments. A former scientific advisor for Delhi's EPCA[66] said, 'To set a standard, you need to know the industry and the abatement technology… You cannot set a standard unless you know the mechanics of how the technology works'[67] (referring here to automobile engineering and design). Furthermore, setting a standard symbolises the skill of Board members in merging different technical disciplines. 'In order to develop a standard, you need to think inventively, since standards are as much about engineering as they are about chemistry and physics'[68].

At the level of rhetoric, the technical narrative used in support of developing standards provides a more 'credible' picture of the regulatory process. In practice however it shifts the emphasis away from organisational practices, and the fact that it is often in the regulators' own interest to pursue 'workable' solutions with polluters. When it comes to factory owners who often try to evade the law (i.e. by negotiating a lower pollution standard or by avoiding compliance altogether), Board members have to be confrontational, but at the same time supportive, of the interests of industry. This

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[66] Environment Pollution (Prevention & Control) Authority is an independent environment committee and regulatory authority constituted by the MoEF to monitor pollution in New Delhi. As in the case of the Board itself membership is based on the close relationship of scientists, industrial lobbies, and government representatives. It includes for instance representatives of the automobile sector (New Delhi at present becoming a growing market for automobile manufacturers), members of the Board, the New Delhi Pollution Control Committee, Delhi government and the MoEF.
[67] Interview with Dr. Khamar, retired engineering professor, IIT, New Delhi, 22 November 2009.
[68] Interview with Dr. Khamar, 22 November 2009.

reflects the ambivalence of regulatory control, since Board members strive to create a balance between the interests of economic activity and that of public welfare (Hawkins, 1984, Fineman, 1998). A senior scientist said, 'You have to be knowledgeable but assertive, neither pro-industry or against industry'[69]. The fact that enforcing a standard can result in sanctions placed upon polluting units suggests that Board members share the belief that they often have to be sympathetic towards industries. 'Enforcing a strict standard from the start doesn't work; however by enforcing it gradually there are better chances in the long run the industries will put in the investment'[70]. Making judgments about the ability of an industry to comply is more likely to depend on the industrial unit owner in question and his personal outlook and attitudes towards pollution mitigation, as opposed to technical considerations alone.

An important point to consider, however, is that during such standard negotiation procedures, industries can exert their power and influence to resist adopting certain standards. During an interview with Mr. Raghavendra, a retired scientist who participated frequently in standard setting negotiations, he explained: 'although science plays a role, often there is a lot of pressure from industry to speed up negotiations'[71]. As a consequence, he further explained, 'scientists are not given enough time to research a new standard, leading to a number of uncertainties about defining acceptable pollution limits to be effectively ignored'[72]. NGOs and citizen groups also have very little influence over the entire process because their involvement is usually called for after a particular decision has been taken. Mr. Leo Saldhana, an environmental activist based in Bangalore, explained that when he put forward a case to the State Board of Karnataka regarding a factory that was exceeding pollution standards linked to the emission of volatile organic compounds (VOCs), as it turned out, the Board and State Boards were in liaison with the concerned industry. However neither he nor the community affected by the VOCs was called in during the proceedings: it was only after a decision was reached that their comments were invited[73]. It is important to consider therefore that while standard setting is framed as being driven by technical considerations, industrial

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[69] Interview with Mr. Manoj Tanti, senior environment engineer, small-scale industries division, 28 November 2009.
[70] Interview with Dr. Khamar, retired engineering professor, IIT, 22 November 2009.
[71] Interview with Mr. Raghavendra, retired pollution scientist, 22 November 2009
[72] Interview with Mr. Raghavendra, 22 November 2009.
[73] Interview with Mr. Leo Saldanha, director of the Environment Support Group based in Bangalore, 17th November 2009.

interests can often dominate regulatory decisions in a manner that not only undermines the credibility of scientists, but can also restrict in important ways the involvement of citizens groups during standard setting negotiations.

Industrial operators are also aware that speaking the 'right' language and establishing trust with regulatory bodies can influence outcomes in their favour. This has important implications in the context of the peri-urban. For instance, industrialists operating in peri-urban areas often hire private consultants who are well informed about the Board's standards, and how to prepare their audit reports in a language that can be understood by regulators[74]. Local enforcement officials respond positively, preferring to enter a dialogue with the operation concerned in order to meet a particular standard, as opposed to directly exerting their legal influence. By contrast, communities are more likely to depend on the expertise of the pollution enforcement officials working in the area for evaluating whether or not a pollution standard has been met in their locality[75]. This can take a considerable amount of time, as enforcement officials will rarely visit residential areas, and then only after a complaint has been filed with the authority concerned. Given that industrialists have hired their own consultants, there is no guarantee for the communities affected that the audit reports prepared by the industrial operators have not been compiled in a way that plays down violations of environmental norms.

The fact that communities are in a weaker position to challenge regulatory decisions is also explained by the fact that in many cases the same complaint has to be filed repeatedly in order to place pressure on local enforcement officials to conduct an evaluation[76]. It is therefore more likely that local enforcement officials will take a complaint seriously only after a technical evaluation has been conducted by a local NGO or by a scientific representative of the concerned community. The following extract from a public complaint regarding noise pollution, filed with the pollution enforcement agency in the peri-urban case study, tells of the difficulties faced by communities exposed to pollution in influencing regulatory outcomes:

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[74]Information provided by the regional office, U.P. Pollution Control Board, 13th October, 2009, under the RTI Act, 2005.
[75] Information provided by the regional office, U.P. Pollution Control Board, 29 October, 2011, under RTI Act.
[76] ibid, 29 October, 2011, under RTI Act.

> *"The excess smoke more than permissible limit of 150 nm^3 daily comes out of the chimney situated at Magnum Paper Mill. I have orally informed you about the excess emission of this industry many times. I also filed a complaint dated 27.8.2010 regarding more smoke that is beyond permissible limits, but no action has been taken so far. I immediately called the regional officer and sent a text message to monitor the smoke. But the regional officer did not send any team. I immediately took the photographs of the smoke that was coming out of the electric turbine's chimney. But the officials do not come."*[77]

The above discussion suggests that different stakeholder groups have different claims to power when attempting to influence regulatory decisions. Particularly, the various examples drawn both from the peri-urban and other contexts affirm that industrial operators can often use their influence to shape decisions in such ways that suit their own interests. Exerting political influence over standard negotiation processes is one such mechanism of strengthening their influence; however it is important to consider that 'speaking the right language', that is, the technical language which is linked to the Board, can also add power and legitimacy to industry. Industrial operators who are well informed about regulatory procedures and financially able to source the relevant expertise can instigate 'cooperative' relationships with regulatory bodies. By contrast, for poorer communities this is often more difficult. Their relationship with regulators is more likely to be 'confrontational' and subject to the willingness of local enforcement officials to follow up a public complaint procedure. The above insights therefore suggest a more complex picture of why expert bodies can often fail to reach peri-urban areas, and how technical discourse can often serve as a political device that can be mobilised to serve particular interests.

[77] Public complaint sent to the regional office, U.P. Pollution Control Board, 14 January, 2011, under RTI Act.

4.5.3. Forming boundaries: the social practice of industrial monitoring

The importance of shaping boundaries that are closely linked to industries is certainly a subject that comes up frequently in the Board's organisational rhetoric. By mobilising rhetorical statements such as 'we are responsible for industries'[78], the Board constructs a narrative of regulatory practice that is closely attached to the industrial sector. This focus on industry is influenced by two factors. The first is the legal-administrative mandate of the Board with regard to industrial pollution enforcement, a mandate that is much more clearly articulated in official discourses. For instance, effluent 'standards', with ascribed quantitative targets for specific types of industry and categories of pollutants, are enforceable directly by the Board and State Boards in accordance with the Water Act, 1974. The second is the expertise of Board members. Their background training in engineering means that they can apply their knowledge and skills more easily to industrial assessments, as opposed to ecological or health related pollution problems.

The overall approach adopted for monitoring industrial pollution is formulated by the Board members' own discretion and mode of prioritising by way of the different types of activities and polluting enterprises. A narrative that focuses on industry tends to bear certain assumptions about the type of industries that the Board is required to regulate closely. For example, large-scale industrial units such as paper mills and power plants are generally perceived to be more central to the Board's activities. However, smaller factories such as dye-processing units (which tend to operate illegally in peri-urban areas) are frequently perceived to have a negligible impact on water quality[79]. This approach of allocating industrial pollution concerns to large scale industry is often based on the assumption that the pollution load associated with large-scale units is generally far heavier and therefore needs to be monitored more closely.

This is an assumption, however, that is heavily contested in the peri-urban context since small-scale factories can emit equally substantial pollution loads. The peri-urban case shows, for instance, that small-scale industrial units can contribute significantly to the deterioration of water quality, simply because they operate outside the conventional areas where regulators are accustomed to controlling. They operate without effluent treatment plants and release large volumes of untreated wastewater directly into the

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[78] Interview with Dr. Desai, senior scientist of the PAMS division, 10 November 2009.
[79] Ibid.

ground and into the drains[80]. This is in fact something that Board members prefer to ignore. According to the Chairman of the Board, the reason for the deliberate downscaling of regulatory efforts with regard to small-scale industrial operations is because smaller operators are perceived to be uncooperative or simply 'not bothered' about the environment by comparison to larger companies who are better informed about environmental standards, since it is perceived that they are obliged to comply with 'international norms'[81]. These tensions in turn expose the unwillingness of Board members to engage with informal polluters.

Tensions exist also between the 'official' and 'unofficial' regulatory boundaries. Whether or not a water quality standard is being met is usually monitored at the point where industrial effluent is being discharged. This is somewhat related to the way fieldwork strategies are designed, focusing mainly on those sites that make up industrial effluent disposal networks, such as 'drains', 'effluent outlets', 'treatment plants' and 'sewer pipes' [82]. It is at this level that Board members acknowledge having an 'official' obligation to visit the factory concerned and enforce a standard. However water quality can still become impaired even if the load of polluting matter discharged from these sites is controlled, because even if certain units monitored closely by the regulatory authority are demonstrating compliance with water quality standards, there are also those units that are 'unregistered' (i.e. do not possess a formal environmental consent to operate) and are by default beyond regulatory reach[83].

An added complication arises when polluting matter is transferred through various 'informal' channels that are not at present included in the sites that regulators are used to monitoring as part of their fieldwork routines. These include, for instance, direct contamination of the drinking water source and risks caused to the food system by the use of contaminated irrigation water for cultivating food crops (see also next chapter). These are water quality concerns that are recognised 'unofficially', but which the Board members do not perceive themselves as having a mandatory duty to monitor closely.

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[80] Fieldwork observation supported by interviews with community representatives.
[81] Interview with Mr. Sinha, chairman of the Board, 23 February, 2010.
[82] CPCB, 'Monitoring protocol in critically polluted areas', accessed via CPCB website, 20 March 2011.
[83] Information provided by the regional office, U.P. Pollution Control Board, 21th April 2010, under RTI Act, 2005.

Significantly, the way 'official' boundaries are resolved in practice is usually to retreat from certain regulatory commitments. An instructive example here is the regulatory ambiguity posed by human health. Impacts on health from poor water quality is a concern that Board members feel compelled to recognise, but in practice it is 'incompatible' with the monitoring routines adopted for controlling industrial pollution. For instance, the fact that the Board enforces standards limiting pollution load is perceived to be 'life centric'[84], but this often constitutes a theoretical concern that is not followed through in regulatory practices. A Board engineer, anticipating my query about the implications of the Board's monitoring activities for addressing water quality impact on health, said 'we don't really do health [epidemiological] studies - that is the responsibility of the health department'[85]. Therefore, even though Board members support a certain level of recognition of the links between human health and air quality for instance (partly because of the public and media attention that air quality has received in recent years)[86], the same does not hold true for water quality. In general, it is assumed that human health is dealt with by other departments or policy areas within the Indian bureaucracy, even when it is unclear which departments these are and how their mandate might be linked to the Board's. There are several adverse implications of the ambiguity of health impact such as those exemplified by the prolonged exposure of poorer citizens residing in Ghaziabad's urban villages, who are regularly exposed to water pollution discharged by industrial units operating in the locality (see also next chapter, section 5.3.3).

4.5.4. The relationship of the Board with civil society

Board members frequently regard a process of consultation with public stakeholders as a positive step towards better water quality management. A review of the Board's written reports suggests consistency in its support of a narrative of 'spoken' cooperation with civil society and environmental NGO representatives. In the manifesto report of the Board on water quality management for instance, it states 'it is considered desirable to involve local administrative bodies at the district, block, municipal and village levels, NGOs, and the citizens themselves in conducting at least a crude and rapid overall assessment of water quality' (CPCB, 2002: 4). The same report further argues that in 'a

[84] Interview with Mr. Sinha, Board chairman, 23 February, 2010.
[85] Interview with Mr. Raj Kumar, environmental engineer, PCI division of the Board, 22 December 2009.
[86] Interview with Dr. Rao, senior chemist and additional director, 15 November, 2009.

vast country like India', it may not ever be possible to develop an adequate environmental monitoring network based on 'sophisticated' instruments and methodology alone (ibid: 6). Simpler techniques like bio-monitoring 'shall render a lot of satisfaction to rural and local communities' (CPCB, 2002: 8). And so a lack of technical expertise is presented as an opportunity rather than an obstacle for public stakeholders to apply those aspects of water quality management that are not necessarily based on 'complex' methodologies alone.

The perceptions of citizens' and environment groups however suggest an increasingly more sceptical and distant public than the Board portrays in its documentation. This is partly because of the way the Board allocates specific roles for the involvement of civil society. According to Mr. Dunu Roy who leads the Hazards Centre (a small environmental group in Delhi), the Board's approach to water quality operates within a narrow framework of science: 'the bandwidth within which the technical solutions to water quality are being created by the Board is extremely narrow'[87]. This is frequently perceived as a structural hindrance to protecting water quality that can erode civil society's willingness to cooperate with Board members. Others perceive that the official rhetoric of science-based methodologies underplays the influence 'commercial' interests are able to exercise over the regulatory process. For civil society to work in closer partnership with regulatory authorities some perceive that regulatory standards should be set on the basis of 'natural viability as opposed to commercial viability'[88].

A more critical view of regulatory 'science' influences in several ways the kind of engagement civil society has with regulators. Members of NGOs conduct their own surveys of water quality as a strategy either to challenge official knowledge or to expose sources of pollution that are not included in the regulators' assessments. In the peri-urban case study, Janhit Foundation, a local environmental NGO with its own team of experts, conducted assessments in areas that are not routinely included in the work of local regulators. This work exposed the fact that in the poorer villages, concentrations of heavy metals are often over the permissible standards (Lewis, 2007). However, NGOs have difficulty getting regulators to recognise their sources of information and often

[87] Interview with Mr. Dunu Roy, director of Hazards Centre based in New Delhi, 22 March 2009.
[88] Interview with Mr. Sunil Mehta, environmental activist and journalist, 17 November 2009.

need to go to court as a last resort in order for serious pollution risks to be formally recognised.

In other instances, activists take up the task of tracing information about the practices of industries. In the peri-urban case study, Sushil Raghav's lack of trust in the capacity of industry to conform to environmental norms has meant that he regularly exercises his right to access 'official' information (under the Right to Information Act, 2005) in order to obtain information from regulatory authorities. This can be viewed as a strategy to expose industrial malpractice through obtaining evidence pertaining to a non-conforming industry, with a view to further using this evidence for directly challenging the performance of regulators. These examples demonstrate that, despite the rhetoric of cooperation being reproduced by the Board, NGOs and civil society representatives in many instances have to use unorthodox routes for obtaining information.

The situation of the Board's engagement with civil society, however, may be more complex than it appears at the surface. In the two-day symposium held in Delhi on '*Science, Environment and Media: Discussing Experiences in South Asia*'[89], some scientists asserted the view that fostering greater engagement with the public is in fact an exercise that can critically undermine their 'professional' credibility. Lalit Rao, a climate scientist from IIT Delhi who was present at the symposium, provided some explanations for this. In his view, 'if scientists were to respond to all the criticisms then they would lose their credibility amongst other scientists'. Instead, again in his view, the general mood within the scientific community in India is that scientists prefer to 'stick to their own peer reviewed journals'[90]. Although such views were not expressed openly during my discussion with Board members, they suggest that in the Indian context environmental decision-making has over the years become much more politicised, which is why it is in the interest of scientists to limit their involvement with the public realm as a strategy to protect their credibility. This partly explains why the relationship between Board scientists and civil society actors appear to have become much more unstable.

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[89] This is a two-day event that was organised by Panos South Asia. It took place at the IIT New Delhi during the 15th-16th November 2009. The aim was to bring together academics, scientists, journalists, lawyers, activists and policymakers in order to foster a dialogue amongst science and technology professionals, and representatives from the popular media in India.

[90] Interview with Mr. Lalit Rao, senior climate scientist from IIT New Delhi, 15th November 2009.

4.6. Conclusion

This chapter has highlighted a number of issues regarding the involvement of experts in decision-making processes relevant to water quality management. It has highlighted a variety of discursive mechanisms that are used by experts to classify different industrial operators, their own interpretations of environmental law and the way different arguments are presented to effectively 'micro-manage' their interaction with environmental pressure groups and concerned citizens. Furthermore, insights from this case study highlight that failures in policy implementation are often not solely the result of an ineffective administration, or constraints on resources, but are partly an outcome of how the interests of key actors in the policy process are effectively negotiated in the regulatory sphere. These range from the interests of Board members themselves, and those of the other departments in the bureaucracy, to the interests of industry. One issue that emerged quite clearly was the strong influence that industry can have in shaping regulatory decisions, despite significant policy and regulatory reforms that have taken place in India over the past 20 years.

The insights derived from this case study are therefore of particular relevance to the peri-urban context. Firstly, it has helped illustrate deeper conceptual problems in how water quality management is defined within the regulatory sphere. For instance, an overarching emphasis on the DBU classification promoted a tendency to undermine uncertainties associated with water quality protection, and excluded from regulatory control pollution effects that tend to have the most current impact on peri-urban environments. It revealed problems associated with the way the notion of participation has been socially constructed by Board members. That is to say, participation is largely dependent on communicating with regulators in a 'technical language' and a background in expert science disciplines is regarded as a prerequisite for effective participation. This is why NGOs and citizens exposed to deteriorating water quality, and who rely less on technical accounts of water quality, tend to have fewer opportunities to influence policy and regulatory outcomes than in-house experts working from within the Board.

This chapter has focused more on how policy agendas are articulated by key policy actors at the national level, and to some extent by city level actors as well (particularly environmental activists, retired officials, and scientists working for universities in

Delhi). The next chapter will explore in much more depth how water quality is negotiated at the local level, in the trans-Hindon, Ghaziabad, thus shifting analytical attention from the processes of policy ‘framing’ to those of policy implementation.

Chapter 5 Policy translations in peri-urban Delhi

The previous chapter demonstrated that even though the Board scientists operate in Delhi they constitute an important group of actors influencing policy priorities in peri-urban areas. It also provided an entry point for looking critically at the *science* of water quality and its limitations, in order to provide a more nuanced account of the official practices that underlie expert knowledge systems.

The previous chapter illustrated that the Board is perceived to be close to policy makers in its role as a provider of scientific expertise, while state pollution control boards are envisaged as implementing bodies, carrying out and executing the environmental policies formulated by the Board in their respective states and districts. However, the fieldwork observations used to inform this chapter show that policies formulated at the top are rarely executed in the straightforward manner commonly set out by Board scientists. While scientists view water quality solely in technical terms, it has different meanings for people in peri-urban areas, particularly in the villages and slum settlements. Secondly, water quality in peri-urban areas is subject to different types of interventions by official actors and institutions that extend beyond the pollution control authorities. There are also noticeable contradictions in how policies are framed and how they are translated into action. These contradictions are manifest both between national actors (i.e. the Board scientists and their expectations around water quality monitoring) and local implementing authorities (i.e. the regional pollution control office), as well as between local authorities operating in the district itself. The incongruities contribute to large gaps in implementation marked by the heavy pollution of the Hindon river, the depletion of the groundwater and the prolonged exposure of local communities to toxic pollutants in the water.

The chapter contends that in the trans-Hindon area of Ghaziabad district situated close to the eastern border of Delhi, water quality is part of a ‘negotiated order’ (Barrett, 2004:253) involving diverse stakeholders and the parallel operation of contrasting styles of expertise (Keeley and Scoones, 1999). It further suggests that powerful actors have a role to play not only at the policy level (i.e. understood by the role of Board scientists in shaping policies), but also at the district level through the informal ties between local level institutions and powerful elite groups (e.g. industrial lobbies, politicians etc.).

However the role of the 'official world' that exists at the bottom end of policy processes is either taken for granted or has been omitted from intellectual scrutiny. Later it is demonstrated that this is quite significant for understanding why deteriorating water quality is still a serious concern in peri-urban areas. Therefore in conjunction with the previous account of scientific expertise (using the case of the Board) it further aims to provide a more complete portrayal of formal policy responses to peri-urban areas, employing both a bottom-up and a top-down approach.

Section 5.1 introduces the area of study. In section 5.2 an account of the official system for addressing water quality is given, highlighting the institutional priorities of pollution control authorities, the urban authorities and the water departments. Insights of middle level and senior officials perceived as 'frontline functionaries' (Coelho, 2004:140) help to illustrate some of the background assumptions that influence the ways in which district officials exclude the poor from routine engagement with water quality. Section 5.3 draws largely from interviews with residents of the villages and slum settlements to bring into the foreground the contradictions that arise between the dominant narratives of experts and district officials and how water quality is experienced on the ground by diverse publics.

5.1. The study area: Ghaziabad District, Uttar Pradesh

Ghaziabad district, initially part of the larger region of Meerut, was formed in 1976. The town, also known as the 'hot city', was named after the Muslim king 'Gayajuddin'. It acquired Class 1 status in 1971, marking Ghaziabad's status as a new large town created from previously rural settlements. As well as the growing population, in terms of industry Ghaziabad is also the second largest town in the state of Uttar Pradesh (after Kanpur) with approximately 13,000 industrial units registered with government records[91]. The growth potential of Ghaziabad has been harnessed by the state government of Uttar Pradesh (U.P.), expanding particularly after the 1990s with the onset of India's neoliberal economic reforms and the emergence of India's middle class.

Ghaziabad's growth was facilitated by several factors. Firstly, it is located very close to Delhi, the national capital (about 30 kilometers away). A map is shown in Figure 4. Secondly, the state government of Uttar Pradesh has undertaken various policy initiatives to encourage industries to come to Ghaziabad. The industrialisation of Ghaziabad has a long history. It starts in the 1960s with the acquisition of land under the direction of the U.P. administration and has continued in consecutive years through numerous government notifications for the acquisition of agricultural land from the villages. To date, nearly 1500 acres of agricultural land have been acquired from roughly 50 villages for the industrial development of the region[92]. This land is now under the auspices of the Uttar Pradesh Industrial Development Corporation (UPSIDC) and includes large industrial estates such as Sahibabad, Loni and Meerut Road. The legal basis for the acquisition of this land rests with the Land Acquisition Act of 1894, the reason given at the time of the acquisition being that the land was required for 'public purpose'[93]. But the haste with which the land acquisition took place has brought major transformations to the peripheral villages, and has created widespread dissatisfaction amongst the villagers and farmers, many of whom are still taking legal action to claim the financial compensation promised by the U.P government for the land that was acquired.

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[91] Information provided by the regional office, U.P. Pollution Control Board, 28th April, 2010, under the RTI Act, 2005.
[92] Information provided by Government of Uttar Pradesh (U.P.), under the RTI Act, 2005.
[93] Statement as seen in official documents, under RTI Act 2005.

Thirdly, Delhi's urban restructuring in the climate of neo-liberalisation has further fueled Ghaziabad's growth. The Ghaziabad Master Plan 2021 bears many resemblances to the Delhi Master Plan for 2021, both in terms of its overall vision as well as the type of uses defined under the plan for further development. It is highly focused on 'regional integration' and the development of commercial centres, multiplexes, and 'planned' residential localities similar to those found in the capital. Increases in land prices in Delhi have meant that many of the elite of Delhi's workforce prefer to live in Ghaziabad. Middle and senior level government employees, journalists, private sector employees and owners of small/medium enterprises maintain a more 'middle class' lifestyle, and have their own private transport. In addition, because the level of affluence is increasing in Delhi, poorer rural migrants are also coming to Ghaziabad[94] in order to find cheaper rented accommodation while commuting to the capital to work as low-wage labourers. An important characteristic of this process is that the visual landscape of Ghaziabad has been drastically transformed. Modern high rise buildings (residential as well as commercial) now co-exist with industrial and village settlement areas. An increasing number of these settlements have deteriorated to such an extent because of Ghaziabad's urbanisation that villages have in reality become slums[95] (see also Figure 5). These processes are indicative of the polarisation that exists between social groups in the district of Ghaziabad, and how this polarisation is interlinked with the societal and economic changes taking place in the capital.

[94] An observation well established in the peri-urban literature is that rural out-migrants do not generally go directly to large cities. Instead, a series of moves is involved, called step migration, wherein rural migrants move first to villages or small towns and then successively to more urban environments. See also (Narain, 2009).

[95] The municipal corporation has declared 23 rural areas as slums. Most of these urbanised rural areas lack basic facilities. This is due to the haphazard nature of the developments and lack of funds. Population densities in these villages are alarmingly high and the family sizes are also larger than average.

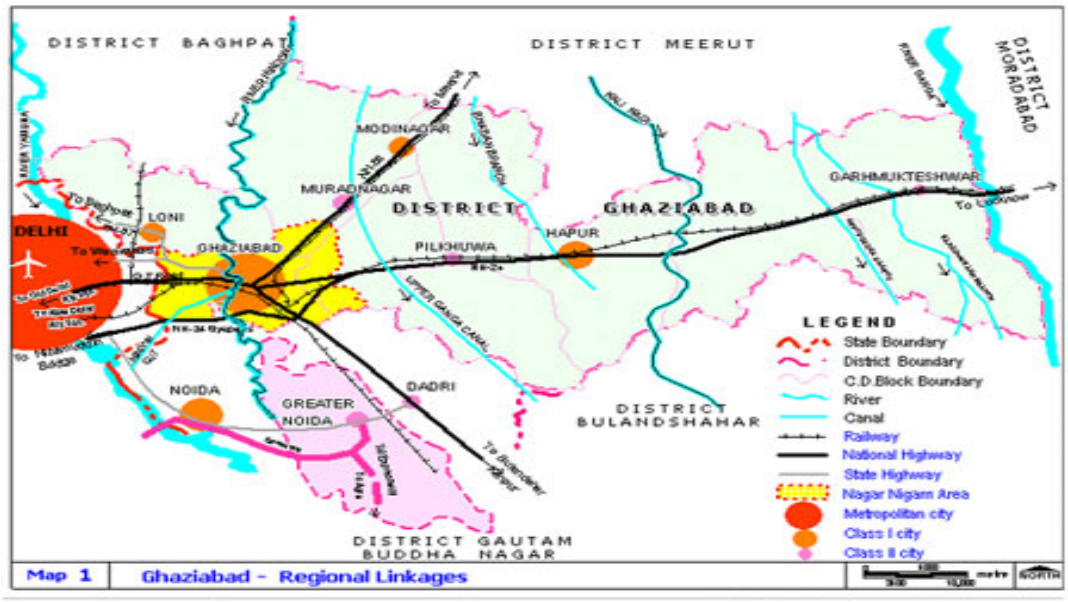

Figure 4: Location of Ghaziabad district in relation to New Delhi

Residential blocks in Vasundhara

Roof view of KarKar Model village

Small/medium factories

Magnum paper mills

Figure 5: Types of land use in the trans-Hindon region

Ghaziabad's peri-urban transformation has undoubtedly left its mark on the water quality of the region, which is observed to be deteriorating rapidly. The river Hindon[96], historically known as 'Harnandi', is the main water body flowing through Ghaziabad district. It is heavily polluted by industrial as well as domestic sources, including sources in other districts and industrial towns located upstream from Ghaziabad, such as Muzaffarnagar, Meerut and Baghpat. In addition, water pollution has increased because of new pressures from pollution sources found within the district of Ghaziabad. Residents attribute water (and environmental) pollution in the district to the increasing number of 'hazardous waste disposal' businesses[97] operating illegally. Illegal factories tend to operate without functioning Effluent Treatment Plants (ETPs) and often no underground sewage disposal system, meaning that a lot of industrial waste is dumped directly into the river Hindon.

Environmental degradation in the district is certainly not a new phenomenon since Ghaziabad has hosted polluting industries as far back as the 1950s, which is when the U.P Government initiated the land acquisition process for industrial development in the region. However, the number of illegal industrial units operating in the district has increased as a result of Delhi's beautification policies and because many industries that have been pushed out of Delhi have 'resettled' (without planning permission) in the established industrial sites located in the district. This is reflected in the official records of the regional Uttar Pradesh Pollution Control Board (UPPCB), which attribute the increase in pollution levels to a list of 140 units that are currently operating in the district without an operating license[98]. These industries have been established primarily through channels of informal negotiation with the state industrial corporation, the UPSIDC, the government authority responsible for the lease of land for industrial purposes. Given the relatively large plots of land at the disposal of the UPSIDC it has been entirely possible for illegal businesses to settle, either in vacant plots or by 'sub-contracting' land on a temporary basis from the owners of units already there.

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[96] The Hindon river flows through six districts and it stretches over 260kms. It originates in the lower Himalayas at Parka Tanka village and reaches its final confluence with the Yamuna river in Gautambudh Nagar, downstream of Delhi. It has two main tributaries, the Krishni river which joins the Hindon at Barnawa village and the Kali river, which joins the Hindon at Pithlokar.

[97] Such industries operating in Ghaziabad include for example, electroplating industries, chemical manufacturing units (including pharmaceuticals), dye and dying industries, petrochemical products, leathers and textiles.

[98] Information provided by the regional office, U.P. Pollution Control Board, under the RTI Act, 2005.

Figure 6 is a map of the trans-Hindon area[99] where the majority of interviews and fieldwork observations took place. It demonstrates that in Sahibabad industrial estate the area of land that is 'officially' not used for industrial purposes is quite significant. However, what the official records do not show is that this is the same area where the majority of the illegal industries are now located. As section 5.3.3 will explore, the establishment of illegal industries in Sahibabad industrial area has contributed in several ways to the deterioration of water quality. Industrial pollution further constitutes an important public health concern for the village residents who, since their land was acquired by the UPSIDC, have been forced to reside in very close proximity to these factories.

Within the region, perceptions around problems of deteriorating water quality tend to vary significantly between different actor groups, and depending on whether a particular group resides in an elite residential colony, a migrant settlement, or an urbanising village. Furthermore, there are differences to note in terms of how the state decides to intervene in the water problems affecting different localities within Ghaziabad. Often discrimination, legitimised by state policy, can be clearly observed, resulting in poorer and socio-politically less powerful groups being more severely affected by water pollution, while the middle class citizens residing in gated communities, perceived as far more 'deserving' (i.e. in terms of access to water and wastewater infrastructure), are relatively insulated from the risks of water pollution.

Particularly, in the trans-Hindon area, the inherent 'messiness' of policy implementation and the fact that policies related to water quality management can be influenced by unequal power relations are clearly visible. For the better off middle-class colonies of Vasundhara and Vaishali, access to water and the disposal of sewage is no longer something which is even thought about, as these colonies have grown accustomed to being connected to the municipally managed water and sanitation infrastructure. The Ghaziabad Development Authority (GDA) procures water directly from the Ganges in

[99] The urbanised part of the district, the Ghaziabad Development Authority is split into what is commonly cited as east of Hindon (or cis-Hindon) containing roughly 2/3rd of the population, and the trans-Hindon with 1/3rd of the population. The trans-Hindon is the urban agglomeration which is closer to the immediate vicinity of the city of Delhi

the upper Himalayan region[100]. The water is then treated at the Pratab Vihar water treatment plant (WTP) before being delivered to Vasundhara, Vaishali and emerging middle class colonies in the adjoining district of NOIDA. None of the residents depend on or need to use any other source of water for fulfilling their basic water requirements, and this largely insulates them from local water pollution risks such as the degradation of the groundwater from industrial pollution. Officials see no problem with this arrangement; as a GDA official said in an interview 'groundwater in the district is polluted, that is why we provide piped water from the Ganga Water Project to Vasundhara and Vaishali'[101]. Ironically, however, residents of these colonies are made to pay only a negligible fee for their water supply and rarely perceive their residencies as being at risk from the pollution of the river and the groundwater in the district.

Sewage disposal is another matter which is 'taken for granted' in these colonies. Vasundhara has a vast and effective underground network for sewage disposal, and during this research no form of waterlogging or wastewater accumulation could be identified within the residential areas. Furthermore, all sewage is treated in the sewage treatment plant (STP) at Indira Puram, situated close to the colonies. Of course not all wastewater gets treated at the Indira Puram STP, and an increasing quantity of domestic wastewater is also discharged directly into the river Hindon. However, none of the residents seem to either know or be concerned about where and how the wastewater gets disposed of, after it is flushed out of their houses. Pollution is understood by residents to be increasing because of the heavy industrialisation taking place in the district, but risks from pollution, for now at least, are perceived to exist 'outside the premises' of their colonies. The official bodies in the district have diligently planned the provision of infrastructure so that this can be realised in practice. The UPPCB regional office also operates at a safe distance from where the pollution takes place. It is situated within the boundaries of Vasundhara as opposed to being based in the industrial estates where it could presumably monitor pollution with much greater effect, see also Figure 6.

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[100] Similar is the case for the middle class colonies of Delhi. The local water source, the Yamuna river, as well as the groundwater, is considered to be too heavily polluted for human consumption. Therefore the Delhi Jal Board (Delhi's water authority) has decided to resolve this problem by procuring water directly from the Himalayan region. The downside of this process is that the ecological sustainability of the Ganges is becoming greatly impaired from over-abstraction, while communities residing in the Himalayan region witness their local sources of water, used both for irrigation and consumption, being diminishing rapidly (Maria, 2006).

[101] Interview with Mr. Anand, chief town planner, Ghaziabad Development Authority, 16th January 2010.

In comparison to the ‘pollution-free’ colonies of Vasundhara and Vaishali, urbanising villages located in the trans-Hindon area, such as Arthala, Maharjpur and KarKar Model, experience problems in a different way. This is partly linked to their social status in the district. These villages are conglomerations of small localities housing primarily poor people who work in the informal sector in occupations such as home-based artisans, street hawkers and vendors, casual labourers, security guards, carpenters, petty shop owners, and other ‘blue-collar jobs’. With major industrial areas either surrounding the villages or located in close proximity to them, it is clear that many of the residents are also representative of a ‘labour-class’ who work for the industries and reside near their work places.

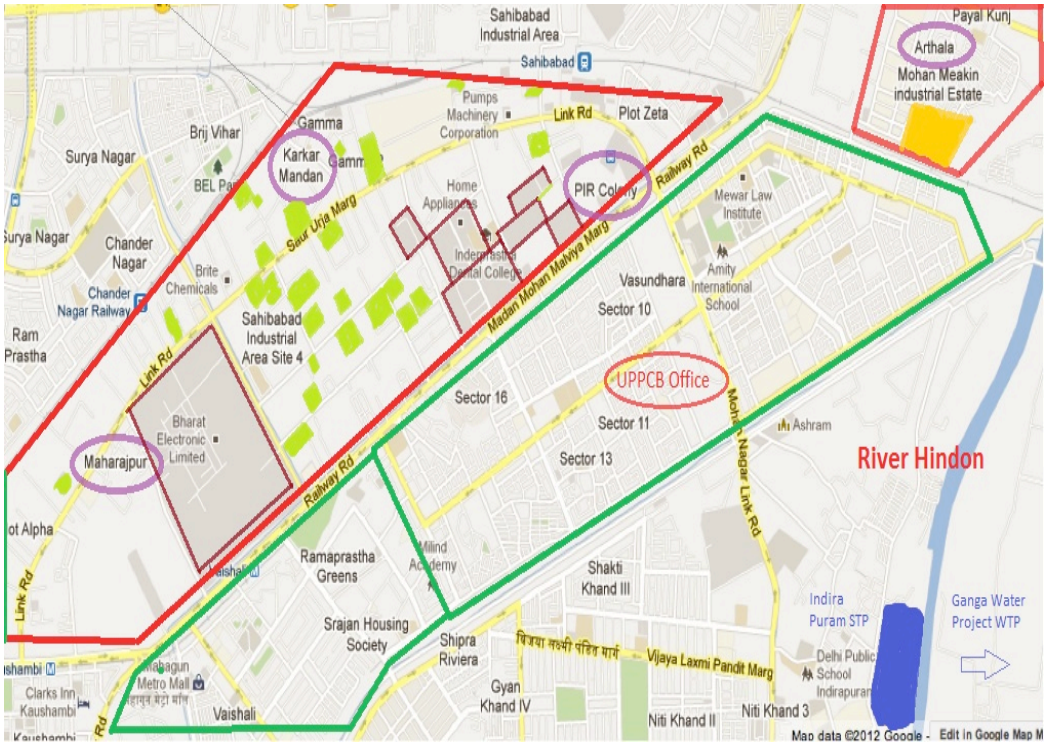
The relatively ‘better-off’ residents of these localities are those that consider themselves to be part of the ‘actual’ village, that is the village prior to when the urbanisation of these localities began to take place. Some residents therefore claim to be the earlier settlers in this area, and are perceived as the ‘native’ population comprising mainly old castes such as Rajputs (upper caste land owners), Jats (farmers), Gujjars and Tyagis. It is these social groups that are more openly ‘anti-state’ as these are the same villagers that saw their farmlands forcefully acquired by the state of U.P., a process which has clearly led to the progressive disempowerment of villagers in terms of their right to land in the district. However, it is generally the ‘newcomers’ such as migrant populations that work in factories or commute to Delhi to work as informal labourers and who generally have no landholdings that are the most disadvantaged in this region. The migrant populations generally receive little recognition from the state and are often looked down upon by other village residents. From a class perspective, there is a clear dividing line between the ‘poor’ of the district that have come to reside in the villages and the ‘elite’ residents of colonies such as Vasundhara and Vaishali.

In these parts of the trans-Hindon area the water quality risks presented are more acute and widely dispersed. Insufficiency of ‘modern’ municipal water supplies has forced villages to withdraw groundwater. However, pressures on the groundwater from industrial pollution and over-extraction mean that water quality is often impaired, exhibiting high levels of salinity and heavy metal toxicity (due to industrial pollutants). Lack of access to underground sewage disposal facilities means that in the villages wastewater floods the open drains and alleys, accumulating in scattered cesspools within the localities. The problem of water pollution is accentuated by the fact that

villages are located within the industrial estates. In the parts of the villages that have been transformed into slums, such as the Ambedkar Nagar slum adjacent to Arthala village, the GDA has made no provision for basic services. Here the risks are further accentuated due to the fact that slum residents (mainly migrant populations) have little disposable income to purchase bottled water and therefore depend entirely on water accessed illegally from the pipelines used to deliver water to the middle class residential colonies. As a result, the quality of water is rarely guaranteed, leading to adverse impact on health and the loss of lives from the consumption of contaminated water.

Ultimately, some of the underlying causes of the inequalities observed can be traced to the gentrification of the peri-urban space under a state led planning framework which is designed to appeal to the elite of the region whilst intentionally leaving the poorer groups out of the development process. For instance, the statement made by Mr. Ajay Kadam, the Municipal Commissioner of Ghaziabad Nagar Nigam, encapsulates quite vividly the type of development vision shared by state officials in the district[102]. When he felt he had to justify why the poorer groups in the district have to live in unacceptable environmental conditions, he said: 'we are planning and trying to implement the best of the schemes possible, and available within existing the resources…the results however will be better in the future and one needs to have patience', hoping to convey that in time 'even the poor' will be able to benefit from the recent development of Ghaziabad. But for now at least, the poor are rarely perceived as a priority and this is reflected in the official discourse, while a particular 'anti-poor' bias that officials bring into their practice in part becomes responsible for widening the gap between the poor and affluent peri-urban residents.

[102] Interview with Mr. Ajay Kadam, the municipal commissioner of Ghaziabad, 16th January 2010.



Ambedkar Nagar Slum
Village Area
'Posh' Residential Colony

Industrial Area Perimeter
Large Scale Industrial Plots
Small Scale Industrial Plots

Figure 6: Map of the trans-Hindon area and field-visit locations

5.2. Water quality and the 'official world'

In this overall context of transition, water quality lends itself to a host of formal policy interventions and official actors. Figure 7 demonstrates that the institutional structure of the Board and State Boards is influential. The regional office of the Uttar Pradesh Pollution Control Board (UPPCB), being the main pollution enforcement agency in the district with a mandate for addressing water quality, is placed in the centre. However, water quality management is also shaped indirectly by multiple agencies (i.e. beyond the scope of the Boards) whose roles are less clearly defined. As the following sections demonstrate, even though they have an important role in water quality management, a significant limitation of this institutional set up is that the relationship between them tends to be highly fragmented. Furthermore, not all actors are situated within Ghaziabad. The UPPCB for example operates at the state level and is based in Lucknow. The CPCB (referred to as the Board in Chapter 4) and the Central Groundwater Board (CGWB) operate at the national level and are based in Delhi.

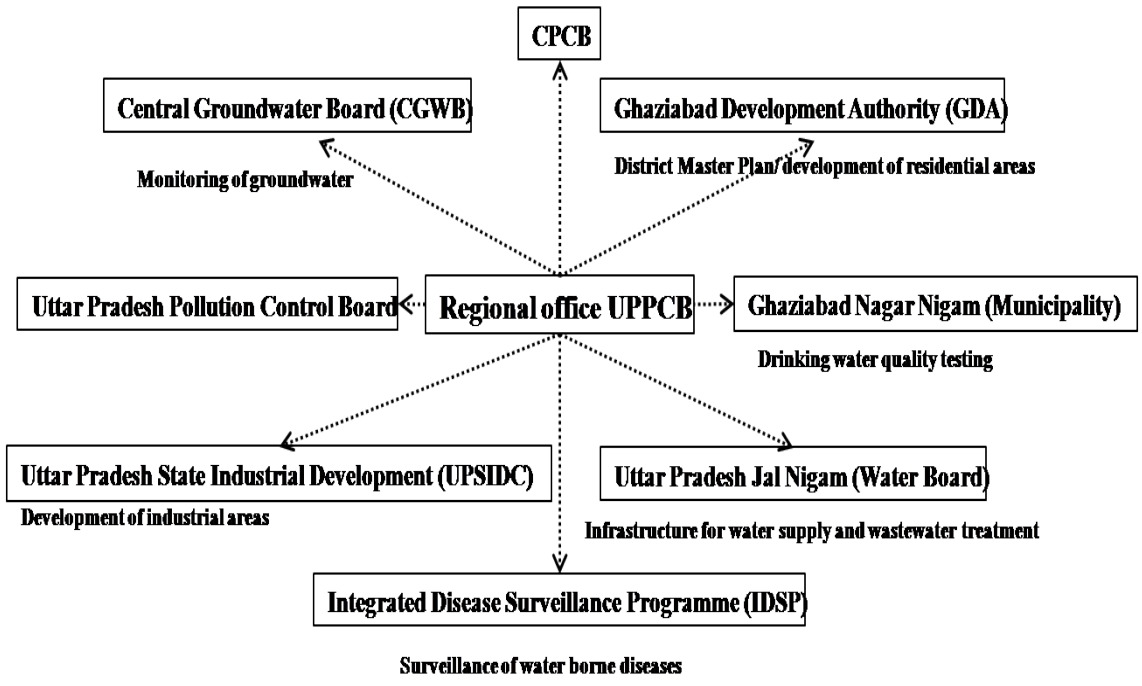


Figure 7: Overview of official actors influencing water quality management

5.2.1. The role of the regional office UPPCB

From the official perspective, water quality in the sense of a district concern is frequently linked to the regional office of the UPPCB, the implementing organ of the State Board of Uttar Pradesh, which is based in Lucknow. Like the Board itself (previous chapter), the regional office was established in 1995 and has a similar organisational structure. A key difference between the Board and the regional office UPPCB is that the regional office does not conduct technical studies or research. Given the considerable presence of industries in the district, its main area of activity is checking for industrial compliance with pollution abatement norms. Water quality is therefore monitored within the industrial estates, but also periodically at designated points along rivers and in groundwater, lakes and ponds.

But unlike the Board, which has a set allocation of funds and resources for the monitoring of water bodies, the regional office works with very limited resources and manpower. Given also the volume of industrial units operating in the district, pollution enforcement officials tend to prioritise monitoring efforts much more around the enforcement of standards related to industrial pollution. This is the first important aspect of how policies are translated in peri-urban areas. The Board has incorporated into its mandate the environmental implications of deteriorating water quality (for instance much of the emphasis of its own monitoring programmes is on river pollution) but in practice the 'environmental' implications are not adopted very well at the peri-urban scale. This is exemplified by the serious deterioration of the local river Hindon due to industrial and domestic wastewater discharge. Moreover, monitoring water pollution is narrowed down to a regime of merely checking compliance of industrial units, providing few possibilities for pollution enforcement agents to take notice of other types of risks arising from impaired water quality. This becomes evident in section 5.3.2, which discusses the citizens' exposure to pollution but also in section 5.3.3, which gives examples of less recognised sources and impacts of pollution.

Monitoring industrial compliance with environmental norms is conducted for the 17 categories of polluting industries in the district. The list includes paper mills, sugar mills, alcohol distilleries, tanneries, slaughter houses and more recently established processing industries including dye and dyeing industries, electroplating, metal processing and electronics. Monitoring is carried out through taking water samples at

the point of discharge, i.e. from the wastewater outlets of factories. Water samples are analysed for compliance with permissible limits according to a range of core parameters that are industry and location specific. The Board formulates the core parameters at the national level, under the Minimal National Standards scheme for industrial pollution abatement (MINAS).

Despite the fact that the design of the monitoring process has largely been expert driven and actively promoted by scientists, in practice pollution control at a district level functions largely autonomously from national regulators. At one level, the limited presence of the Board in the district can be inferred from the ways in which pollution enforcement officials in peri-urban areas perceive the relationship with the Board. On the one hand interviews with pollution control officials suggest that there is little incentive for them to engage with Board members. The director of the regional office perceived the relationship with the Board as such, saying, 'we collaborate with them [the Board] on some projects but fundamentally we report to Lucknow'[103]. And then on the other hand, although Board standards are referred to in order to demonstrate the scientific legitimacy of the regulatory process ('we follow the water standards of the Board'[104]), it rarely goes beyond casual reference to the national regulatory guidelines.

Partly as a consequence of the Board's limited involvement in peri-urban areas, officials in the district attribute importance to problems and pollution impacts that are normally underplayed in the Board members' discourse. While Board members view industrial pollution caused by small scale industry as being diligently monitored (see section 4.5.3), officials in the district often perceive small factories to be the most serious offenders. As described by Mr. Vivek Nain, an assistant engineer for the regional office UPPCB: 'the dye and dyeing industry is the toughest to monitor despite the fact that they are smaller than the paper mills and other heavy industries in the district'[105]. The fact that some polluters can avoid regulatory action in turn reveals some of the complexities of translating the regulatory norms designed by the Board into action in peri-urban areas. As we heard during meetings with officials, many polluting businesses operating in the district are constantly shifting locations. It is common therefore for

[103] Interview with Mr. Jadav, director of the UPPCB regional office, 12th February.
[104] Ibid.
[105] Minutes from the STEPS peri-urban project meeting with Ghaziabad officials in New Delhi, November 30th 2009.

many industrial units to operate on rented sites, which means that the owners can move at short notice to another site and avoid the threat of regulatory action[106].

Another area of contradiction between the Board rhetoric and the operation of the regional office is the way executive power is shared between local pollution control bodies and other formal institutions. Board members identify strongly with industrial pollution concerns not only in terms of their scientific engagement but also as regulators with important executive powers to close industrial units and impose penalties. But pollution enforcement officials note a number of difficulties in closing down a polluting factory even when it fails on several counts to comply with pollution norms.

In theory, if the rules are being breached then the regional office UPPCB sends a notice to the particular business and informs the administrative Head Office in Lucknow. If the owner does not reply within a given time frame despite repeated notices, then the regional office UPPCB can proceed with a closure order. In practice, however, this entire process can take up to 4-5 months and within this time frame the owner can move on to a new place. An added complication is that, even at the time of closure, the regional office UPPCB cannot operate alone, since closing down a business requires the presence of the police and the consent of the district administrative office[107]. These administrative hurdles prolong even further the time lapse between serving a notice and closing down a factory, whilst reducing the capacity of enforcement officials to operate independently and effectively when action is required.

Part of the reason given by enforcement officials for the weak influence of the regional office UPPCB over regulatory procedures is that decisions are often centralised, and in reality administrative power rests at the level of the state of Uttar Pradesh and not the district. Reasons for this curious distribution of power are partly historical, linked to Ghaziabad's industrial development that started in the 1960s and the subsequent unprecedented growth of 'industrial estates' (see previous section 5.1). These estates were initially planned to operate as designated zones where industrial development was less restricted but this has also meant that regulatory bodies have less influence in these areas.

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[106] Minutes from the STEPS peri-urban project meeting with Ghaziabad officials in New Delhi, November 30th 2009.
[107] ibid.

Enforcement officials explained:

> *'We are completely dependent on the administration. Those who drafted the Act did not want the engineers to have the authority to go and seal these big factories. At that point, pollution was not the main priority. It was the social benefits being derived from industry. So they devised this elaborate procedure of 2-3 months that has to be done before someone can be prosecuted*[108]*.'*

The majority of the industries found in the trans-Hindon are situated within 'notified' industrial estates. In these areas the UPSIDC is responsible for granting consents of operation to industrial operators Nonetheless, industrial development has, in recent years, become haphazard and unplanned, easily taken over by the vested interests of industrial elites. It is worth noting that, because of a curious legislative inscription in the EIA guidelines, hazardous waste businesses can be established without either a public hearing or consultation with the affected communities[109] (Menon and Kohli, 2008), not even the villages that are often situated within industrial estates.

Another major point of contention is the fact that, although industrial land was originally allocated for the 'public purpose', at present this land is being appropriated for the establishment of large shopping complexes and industrial activities whereby plots are subdivided informally into smaller plots to accommodate more industrial units. Local enforcement officials perceive that they have little real influence in shaping regulatory decisions in these areas because the executive power of the UPSIDC, in conjunction with state level bureaucrats, supersedes their own regulatory authority. This was eloquently described in an interview with the regional office director, who said 'I am doing my job but there is a lot of pressure from above'[110] (referring to the state capital Lucknow), highlighting that a type of 'economics first' politics appears to pervade state level decisions as well.

As I was told informally during interviews with an official from the UPSIDC, state politicians based in Lucknow would have much to lose from creating a more effective

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[108] Minutes from the STEPS peri-urban project meeting with Ghaziabad officials in New Delhi, November 30th 2009.
[109] Information provided by the regional office, U.P. Pollution Control Board, Ghaziabad, 28th April, 2010, under the RTI Act.
[110] Interview with Mr. Jadav, director UPPCB regional office, 12th February, 2010.

pollution enforcement mechanism in Ghaziabad, because that would counteract the 'special incentives' industrial policy that the U.P government has drafted for the region. Such incentives include exemptions from income tax, transport subsidies and other measures put in place to encourage industrialists to set up units of operation within Ghaziabad district. The state government fears therefore that striking a better balance between environmental protection and industrial development could be a risky course, and could potentially encourage industries to relocate from the Ghaziabad to other regions. This in turn would lead to a sizable decrease in state revenues because of the lost taxation and rental incomes.

In addition, as I was told by an official source, that many of the industrial operations in Ghaziabad are tied to a much more powerful industrial lobby based in Lucknow. According to another anonymous source from the UPSIDC, industrialists have set up operations in Ghaziabad because of the district's proximity to Delhi. This is a strategic location for industry because it gives access to transport infrastructure (i.e. airports, railway networks etc.), a growing urban market and telecommunication services that are much harder to access in other parts of U.P. It is possible therefore that industrialists based in Lucknow are in a better position to influence political decisions and put pressure on the political elite of Uttar Pradesh in order to discourage the implementation of stricter pollution enforcement rules for the region. In section 5.3.3, it is shown that the process of siting industries has in turn encouraged the deterioration of water quality in important ways that are often excluded from the view of regulatory control, despite serious impacts on the local populations residing within these estates.

5.2.2. Influential actors beyond the PCBs

Officially, the regional office UPPCB has the mandate for water quality. However, 'unofficially', it is an area of concern that overlaps with other institutions. These areas of overlap are not formally recognised either by national level actors or the pollution control officials in the district. More importantly, the dominant view expressed by scientists at the Board is that water quality is related only to pollution control institutions, when, in reality, there are synergies and contestations between policy responses in the areas of industrial pollution control, river pollution and drinking water.

The Uttar Pradesh Water Board (in Hindi, Jal Nigam) operates within the district but its operations are entirely driven by the state. Through its district division it undertakes large scale infrastructure projects to do with water supply and pollution abatement. These projects mainly include the installation and maintenance of sewage treatment plants (STPs) and water treatment plants (WTPs). These infrastructure projects are managed by specialist engineers and chemists who are posted to Ghaziabad from the Water Board's head office in Lucknow on short-term placements, or are sub-contracted through agreements between the government and private engineering firms from Delhi. The engineers are often neither part of the district official system nor residents of Ghaziabad. Their interest in water quality is therefore limited to the technology, and is defined solely by reference to proposals for future projects (mainly STPs and WTPs) and dissemination of information about the existing technological installations.

On meeting an engineer, Mr. Surya Joshi, who works in the pollution abatement and water supply planning unit of the Water Board, one senses that he is well informed about the Water Board's projects, and is also very keen to share his information. But his interests are firmly centred on the technologies. For him, the prospect of tackling poor water quality in the region appears promising because of the two main STPs, one in Indirapuram and one in Dundahera, which have a total treatment capacity of 130 million litres per day[111]. Anticipating my queries on the efficacy of these measures, he adds that under the Yamuna Action Plan (YAP) III, there are proposals for another four STPs to be installed in the district by the year 2025, using funds from the Japan Bank for International Cooperation (JBIC)[112]. A critical insight regarding the aforementioned discourse is that it grossly undermines the politics of access to water and wastewater treatment technologies. As mentioned in section 5.1 none of the residents of the poorer localities, particularly the village settlements, appear to benefit from existing installations, and this is largely because of the way urban authorities have prioritised elite middle class colonies in their existing and future plans for ensuring water quality protection.

It is further evident that western models of sanitary engineering are popularised and heavily promoted by Water Board engineers. The 'utility-based' technological approach

[111] Interview with Mr. Surya Joshi, zonal officer of the Water Board (Jal Nigam), Ghaziabad city 15 April 2010.
[112] Ibid, 15 April 2010.

promoted by the Water Board views the supply of quality drinking water and the removal of wastewater as part of the same cycle. One of the implications of this logic is that the deterioration of water quality from the pollution of the river and groundwater is largely perceived as being outside the engineers' area of influence. As we heard repeatedly in a number of interviews with the water authorities, 'pollution is an area that rests with the regional office UPPCB, not the water authorities; we deal with domestic water supply and treatment'[113], affirming a view of the division of roles that is shared by officials in the district. However, in reality, issues of domestic and industrial pollution are difficult to separate from concerns around drinking water quality. This is demonstrated in section 5.3.2, which describes poorer communities' own assessments of water quality.

An underlying cause for this mismatch is associated with the way policy priorities for the protection of water quality have been institutionalised at higher policy levels. For instance, the Board's DBU classification, explored in section 4.4.1, is typically oriented towards protecting 'organised uses' of water as a first measure, while placing water quality of rivers and water bodies as a second and often lower priority. Thus, although water pollution is associated with a single authority, the UPPCB regional office, drinking water quality is perceived to be a more serious 'official' concern, often better monitored by means of various routine checks and safety measures.

The emphasis on drinking water is reflected in the formal monitoring of the quality of water reaching households. Water quality checks are undertaken at the WTP by the Water Board before it is supplied to the district. Some tests are done on a daily basis, such as pH, turbidity, total hardness, calcium and magnesium. More complicated quality tests, including for heavy metals such as iron and arsenic, are done on a weekly basis. The water is tested for 13 core parameters derived from international agencies, namely the *WHO Guidelines for Drinking Water Quality* (WHO, 2008), and brought into legislation nationally by the Bureau of Indian Standards[114].

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[113] Interview with Mr. Vivek Ramesh, chief engineer of the Ganga Jal water treatment plant, Ghaziabad, 16 April 2010.

[114] The Bureau of Indian Standards (BIS) is the national standards body of India working under the aegis of Ministry of Consumer Affairs, Food & Public Distribution of the Government of India, previously known as the Indian Standards Institution.

Once the water enters the distribution stage, quality testing is carried out at different stages by the Municipal Corporation (in Hindi, Nagar Nigam) including water from pipes, drains, water, and sewage pumping stations. The Integrated Disease Surveillance Programme (IDSP), a team operating under the district hospital, also carries out additional water quality testing. The IDSP keeps a check on the municipal water supply and sends health officials to collect water samples from municipal water pipes, as well as from the point at which water is received by consumers (i.e. from hand pumps in villages and water taps in the residential colonies). An important implication of focusing monitoring strategies around potability is that it excludes poorer water users who do not fall within the 'official' water distribution network and consequently more robust water quality monitoring strategies. This is particularly true of village communities that are not connected to the formal water supply as described in section 5.3.2.

The division of formal responsibilities between pollution control authorities and drinking water is linked to different styles of expertise. Dr. Shastri is a microbiologist from Lucknow who has been posted in Ghaziabad to lead the IDSP programme. In his view water quality involves two main types of assessments: 'detection of coliform bacteria' and the rapid 'H_2S test', both methods are used to measure faecal contamination to prevent water-borne diseases such as dysentery, typhoid fever and hepatitis A[115]. Dr. Shastri is interested in 'contamination of the piped water supply' caused by the 'mixing of wastewater with the drinking water' supplied to the district; 'hard contaminants' (i.e. heavy metals from industries) in the water are not monitored by the IDSP[116]. By contrast, from the perspective of the regional office, UPPCB, the emphasis on the formal water quality assessment is rather different. Mrs. Roy, a scientific officer at the regional office, UPPCB, stated during an interview that monitoring is focused on 'physico-chemical parameters'[117], and that routine checks centred mostly on industrial pollution.

What was inferred from many discussions with officials and from fieldwork observations is that those engaged in water quality monitoring do not share their assessments between their individual departments. This puts up a considerable barrier in the development of integrated responses to water quality. The IDSP reports to the Water

[115] Interview with Dr. Shastri, coordinator of the IDSP Ghaziabad District Hospital, 21st March 2010.
[116] Ibid, 25th March 2010.
[117] Interview with Mrs. Roy, 30th November 2009.

Board, the regional office UPPCB to the UPPCB head office in Lucknow, but there is often little communication between those different strands of expertise. Some degree of formal stakeholder coordination is envisaged through the district's environmental committee[118], but since participation in the committee is strongly biased by the inclusion of senior bureaucrats, members have little direct involvement with the monitoring process. Representatives include the district magistrate, the chief medical officer, the district agricultural officer, the district forest officer and the regional office UPPCB director. This is a missed opportunity because, although there are different bodies of expertise engaged with the assessment of water quality, the way monitoring has become institutionalised prevents flexibility both in the choice of areas for monitoring water more closely and also in the way information is used by different stakeholders to inform decision makers.

A number of lessons can be drawn from exploring how water quality protection is negotiated amongst actors beyond the regional office of the UPPCB. Firstly, as a response to the development that is taking place in the district, the U.P. state authorities have initiated a series of programmes (primarily under YAP and GAP) to improve sewage and water treatment infrastructure. However, the discourse of engineers and officials that work at the sites of sewage and water treatment suggest that decisions are highly centralised and are more likely to emanate from Lucknow than from within Ghaziabad. This has led to a number of areas of oversight in water quality protection. The official system exhibits a preference for securing safe access to water for the elite colonies, while neglecting water quality protection for poorer settlements. Furthermore, there is little indication that these measures are likely to lead to improved environmental protection (e.g. by restoring the ecological sustainability of local water sources, such as the river Hindon) since the focus is on 'end of pipe' solutions, rather than developing strategies for reducing pollution at source.

Given the fact that colonies such as Vasundhara and Vaishali pay a negligible fee for the wastewater treatment and water supply services they receive (see also section 5.1), it is likely that demand for water consumption and disposal will only escalate in the foreseeable future. These problems are further compounded by the fact that although

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[118] Information received from U.P. Government, Environment Department, 29th April, 1992, under RTI Act, 2005.

water engineers work for the district, they often live in adjacent areas. Consequently they have limited information about how different sources of pollution and risks from exposure to pollution are 'spatially' distributed in the district. This in turn very much limits the extent to which adjustments to technological infrastructure can be made or remedial measures put in place so that the benefits of water quality protection can be distributed more evenly across the population (i.e. by expanding technological coverage beyond the middle class localities).

Another issue which deserves greater elaboration is that of water quality monitoring. Insights from the field highlighted that water quality assessments emerge from different agencies of the bureaucracy, beyond the regional office UPPCB. Given the complexity of different sources of pollution, and the diversity of settlements found in the district, improving the sharing of water quality assessment information between the different agencies of the bureaucracy could offer some scope for enriching the knowledge base of officials, and serve to highlight areas of oversight in the evaluation of water quality. However, bureaucratic politics appear to pose a significant barrier to this end becoming realised. For instance, from my discussions with officials of the IDSP I could infer that in several instances officials attempted to pass on information to the regional office UPPPCB, particularly on issues regarding the contamination of the drinking water source (i.e. water from the community tubewell) at villages such as KarKar. Pollution control officials tried to ignore this information, or otherwise attempted to pass it on to the municipal department. The connections between the regional office UPPCB and the industrial and political elite in Lucknow could be one possible reason why this oversight was unavoidable.

Another source of bureaucratic ineffectiveness in the district is the fact that even though an environment committee is in place to take up inter-departmental matters, in practice it appears to be 'non-functional', preventing the IDSP from resorting to a higher official authority for environmental protection. Given also that the IDSP is a relatively small department of Ghaziabad Hospital, other official departments may have little incentive to pay attention to its water quality evaluations. This suggests that apart from the issue of divergent sources of 'official' knowledge on water quality, within the district there are different departments with different degrees of influence, claims to power, and channels of accountability. This in turn suggests that complex bureaucratic politics may

have an equally important influence over efforts of individual experts to foster greater inter-departmental coordination on water quality protection.

5.2.3. District level officials as 'frontline functionaries'

District level officials play an important role in shaping how water quality priorities are negotiated in the district. Unlike the traditional view of policy that assumes that policies are executed in a linear fashion by rational agents, interviews with district level officials bring to the surface how they employ their individual discretion and agency, operating as 'key frontline functionaries' (Coelho, 2004:140) influencing how policy visions are translated into official practice. In contrast to the Board scientists' top-down vision, whereby water quality is viewed as a subject of mechanical objectivity and science, at the district level expert knowledge involves not only science but also social categories, labels and stereotypes (ibid), which are perceived to matter just as much as the science itself for shaping official practice.

The first point of separation between the actors operating at the scale of policy making (represented by the Board scientists) and the implementation regime in the district is the professional training of officials and thus their expertise. Unlike national level policy agents such as the Board scientists who are specialised engineers and scientists with formal training (often holders of a doctoral degree) in water quality management, district level officials are often 'generalists'. Mr. Vivek Nain has the role of 'environmental engineer' at the regional office UPPCB, but in reality he is trained as a civil servant. Like many of the civil servants working in the district, his post is temporary, and he has to adapt quickly to different posts within the administration. That is why he reflects on his expertise as being a 'Jack of all trades'[119], rather than a water quality specialist.

As described in the context of the Board, even at the district and state levels the causes of deteriorating water quality are frequently seen as synonymous with a dominant narrative on population growth[120]. As Mr. Vivek Nain described in an interview, 'water pollution is a result of the unprecedented population growth of the district'[121] (linked to the district's immediate proximity to Delhi). Population growth has brought a huge rise

[119] Interview with Mr. Vivek Nain, assistant engineer of the UPPCB regional office, 18th February 2010.
[120] This argument reflects national regulators views on improving water quality discussed in Chapter 4.
[121] Interview with Mr. Vivek Nain, 18th February 2010.

in real estate development, with no plans for the treatment of the domestic wastewater coming from new residential areas. This dominant view regarding the district water quality problem is frequently reinforced by the modern civil servant's faith in engineering solutions: 'once new modern STPs are constructed that can match new demands, water pollution will be tackled more effectively'[122].

Nevertheless, the shortcomings of technological responses to water quality are much more evident at the local level. As was pointed out in a separate interview with an engineer from the Water Board, the large amount of land required[123], as well as the excessive running costs for building new STPs, makes it too expensive for the Municipal Corporation and the Water Board to take this option seriously. Furthermore, the firm assumption that technology can provide long term solutions to serious pollution impacts affecting the district is contested by fieldwork observations that demonstrate that large-scale technologies only treat wastewater coming from the middle class colonies. As argued by Mr. Neeraj Kumar, one of the Water Board's engineers, proposed plans for STPs in the trans-Hindon area cover Vaishali, Indira Puram, Vashambi, and Vasundhara, implying that the villages and informal colonies are not within the official boundaries[124]. The utilisation and control of technology is therefore strongly linked to the more systemic propagation of inequality in peri-urban areas.

Another point of separation between the techno-scientific framing of water quality adopted by Board scientists and the official practices of these frontline functionaries is that implementation of policies is partly determined by their practical knowledge of the district. This is knowledge that is continually refashioned by the officials' daily encounters with ordinary people who are fixed in place with regard to their geography, social status, and access to municipal services (Coelho, 2004). Essentially, in the officials' view, the district is divided between those that are better served and reside in middle class residential colonies (clearly demarcated in the municipal plan), and those that often lack access to basic municipal services and live in the margins, comprising mainly of slum dwellers and the residents of the urbanised villages who are excluded from the municipal development plan.

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[122] ibid, 18th February 2010.
[123] An additional factor that impedes the feasibility of STPs is the price of land, which has risen sharply due to real estate speculation in the district.
[124] Interview with Mr. Neeraj Kumar, water engineer of the Uttar Pradesh Water Board.

In the official world, these two contrasting social categories lend themselves to different labels and stereotypes. People residing in Ambedkar Nagar, which is a poor slum[125] in the trans-Hindon area, are described as 'dirty' people, and their settlements are classified as 'illegal'[126]. The way illegality is discursively reproduced in planning documents is not unique to peri-urban areas, as commentators in Delhi have argued that social inequalities are often reproduced by presenting poorer settlements as illegal (Ramanathan, 2006). In peri-urban areas the terms 'non-conforming use' and 'unauthorised settlement' are frequently cited to describe Ambedkar Nagar in the Ghaziabad Master Plan 2021 (Ghaziabad Development Authority, 2006). Ambedkar Nagar is 'officially' perceived to provide shelter to low-income groups such as 'migrant labourers'[127], and their settlements are viewed as being temporary in the official discourse. Villages located in the industrial zones in the trans-Hindon, such as KarKar Model in Sahibabad Industrial Sector 4, are considered 'unhygienic' and 'poorly maintained'. By contrast, the newly established residential colonies of Vasundhara and Indirapuram are often referred to discursively using terms such as 'clean', where the population is 'decent' or 'posh', marking that an elite category of citizens resides there (and presumably is more deserving in terms of access to services)[128].

The social labelling employed to chart different populations is further put into motion to protect officials from being held accountable for pollution impacts on the poorer colonies. Mrs. Roy of the regional office UPPCB, reflecting on the routine exposure of Ambedkar colony residents to wastewater overflow and stagnation said 'they have become immune to this water'[129], suggesting that water quality problems of poorer colonies do not figure at all in the daily routines of pollution enforcement officials. The exclusion of the poorer colonies from the official boundaries of the municipality also manifests itself in the case of drinking water. Miss Riya, a health officer with the IDSP,

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[125] In the official jargon simply referred to as *bustee.*
[126] Interview with Mr. Anand, chief town planner of the Ghaziabad Development Authority, 16th January 2010.
[127] The large majority of migrant labourers living in the area work for the industries while some work in Delhi and reside in Ghaziabad because it is regarded more affordable.
[128] Interview with Mr. Anand, 16th January 2010.
[129] Interview with Mrs. Roy, assistant scientific officer of the UPPCB regional office, 18th February 2010.

said 'If I was to drink the same water as they drink in villages, I would certainly fall sick!'[130].

In several instances, it is therefore demonstrated that serious impacts affecting vulnerable populations become normalised in the discourse. Middle level officials relate to their official practice sometimes with humour, employing aphorisms such as 'government work is about circulating documents'[131]. Senior officials, those who are responsible for leading local government departments, are often more protective about the public image of their organisations. The director of regional office UPPCB, Mr. Jadav, referring to the pollution situation in the trans-Hindon, frequently pointed out that 'Ghaziabad's industries have nothing to do with water pollution. We are monitoring everything'[132], using this argument to shift attention away from industrial sources of pollution.

Affected communities and district officials therefore perceive exposure to impaired water quality very differently. In a separate interview, medical official Dr. Saraf, head of the IDSP, stressed that 'poor colonies like Arthala are mainly exposed to air pollution due to the industries but the water is clean'[133]. However, during interviews with citizens of Arthala village, they would oppose this claim, linking the acidic taste of the groundwater with the proximity of their colony to industries (see section 5.3.2). Moreover, from the perspective of local communities, the fact that pollution concerns of poorer colonies are systematically not recognised at senior levels is closely linked to the secrecy with which formal organisations operate on the ground, where 'secrecy becomes the norm (in the functioning of local bodies), and 'access the exception'[134].

The fact that some groups are excluded from the official boundaries is also because the poor are frequently viewed as victims of their own marginality. From the official perspective, drinking water quality is associated with clear jurisdictional boundaries, even if communities residing in the district perceive this differently. Miss Riya from the IDSP said 'we receive a lot of complaints because they think that we are responsible for poor quality water, when in fact it is the responsibility of the Municipal Corporation to

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[130] Interview with Miss Riya, IDSP project officer at the Ghaziabad district hospital, 25th March 2010.
[131] ibid, 25th March 2010.
[132] Interview with Mr. Jadav, 12th February, 2010.
[133] Interview with Dr. Saraf, chief medical officer of the Ghaziabad Hospital 24th March, 2010.
[134] Interview with Sushil Raghav, 23rd February 2010.

resolve these complaints'[135]. Another perceived barrier in serving poorer communities is the bypassing of district officials in favour of those that are considered to have greater political power. For instance, communities frequently prefer to address their complaints regarding polluting industries directly to the district magistrate's office rather than the pollution control authority. This is something that is perceived to obstruct the job of officials. This view was supported in an interview with Mrs. Roy of the regional office UPPCB, who said 'the poor go to the district magistrate because they think he has all the power'[136], undermining the authority of pollution inspectors. In another interview with Mr. Vivek Nain, he said, 'if a plan for a new colony would come to us, we would not give permission if the sewage system is not adequately placed, but then if they go to the district magistrate, he would allow it despite not having a deep understanding of the problem'[137]. It was not possible to interview the district magistrate during the course of the fieldwork; it became apparent, though, from interviews with officials that the district magistrate indirectly influenced many important decisions.

The role of the district magistrate exemplifies two problems with regard to the way water quality is framed at the policy level. First, that although water quality is commonly portrayed by national experts as existing outside the realm of 'politics', in peri-urban areas, the responsiveness of officials with regard to particular sources of pollutants (namely, in the peri-urban case, industrial sources) is largely seen to be dependent upon the 'political' and 'administrative power' of the district magistrate. In the second place, another observation drawn from the peri-urban case study, which further complicates a narrow technical view of water quality, is the way poorer settlements are positioned in the official discourse. Interviews with officials support the contention that the main problems in servicing poorer populations more often tend to be played out in the political as well as social realm. At present, however, conventional interpretations of deteriorating water quality both at the level of agenda setting as well as in procedures of implementation appear to miss out entirely this dynamic interplay between the technical and the political.

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[135] Interview with Miss Riya, 25th March 2010.
[136] Interview with Mrs. Roy, 30th November 2009.
[137] Interview with Mr. Vivek Nain, 30th November 2009.

The fact that water quality risks of the poor are downplayed or ignored by officials is further linked to the wider politics of citizens' representation under the paradigm of neoliberal urbanisation, also discussed in section 1.1. As the middle class mostly live in formally planned colonies, they have access to services that district officials feel legally obliged to provide. This explains, for instance, the discourse of 'purity' and 'cleanliness', which from the point of view of officials appears to be almost synonymous with a 'middle-class' social and residential status. This elite-driven bias can be partly explained by the fact that in these colonies the middle class have achieved greater political representation, and are in a better position than the poorer social groups to mobilise the State so that it takes that 'extra care' which is needed for their well-being and protection from water quality risks. I was told, for instance, by residents in Vashundhara that the municipal corporation regularly shared important information with residents regarding the timing of sewerage infrastructure maintenance work, including annual canal clean up and repairs in the sewerage drainage system. This information was made available in advance through notifications carried in the local newspapers. In addition, middle class colonies were in a position to liaise directly with the municipality through their own Resident Welfare Association (RWA) regarding any complaints related to drinking water quality and sewage disposal.

In the case of the poorer colonies, government agents only responded to specific outbreaks of communicable disease such as cholera or typhoid by implementing control measures, and only after there had been extensive media reporting of incidents of water contamination taking place. In certain poorer colonies, such as Ambedkar Bastee, citizens were able to achieve some degree of political representation by mobilising their local elected corporation member (Sabha Sad) who helped in putting forward community complaints to the district magistrate office. The Sabha Sad could help gain some degree of political representation for the poorer citizens, such as through negotiating the purchase of a submersible pump, or negotiating access to municipal funds for the repair of a pipeline. However, for meeting priorities for water quality protection that required long term planning, funding and implementation of effective maintenance and monitoring systems the level of political representation attained by poorer citizens was much lower, and certainly in comparison to that which middle class colonies have acquired. This coalition of the state with middle class interests has been discussed also in the context of sanitation and water supply delivery in large urban

agglomerations such as Mumbai and Chennai (Coelho, 2004, Chaplin, 2011). However from the official discourses presented in Ghaziabad district it can be inferred that political representation is an equally important factor in peri-urban contexts as well, since it can determine how state officials perceive different social groups and furthermore influences key decisions regarding what services and facilities the state should be able to provide.

5.3. Contradictions between official practice and local realities

Previous sections demonstrated that policy responses to water quality are perceived by district officials to be logically organised between separate departments. However the way formal responsibilities are currently divided in the official world tend to disguise the underlying politics of why certain populations are favoured in formal decision-making processes, while it further underplays a range of policy and regulatory decisions that may be unproductive for ensuring water quality protection. The more apparent ones include for instance the deterioration of the local river Hindon. The emphasis of the following sections is to draw lessons from those water quality problems that tend to be less obvious to officials and policy makers. Furthermore, interviews with peri-urban villagers draw attention to a citizen-driven discourse which, even though it is at its core 'non-technical', is valuable because it addresses the politics of water quality in more detail and draws attention to problems that tend to be overlooked by officials.

5.3.1. The informal depletion of the groundwater

Water quality in the district is often subjected to different expert assessments. The 'official' separation however between institutions that deal with water pollution (the pollution control authorities) and drinking water (the Water Board, municipality and public health authorities) creates areas of oversight in formal planning and policy. One good example is the declining quality of the groundwater in the trans-Hindon. Groundwater being used by villages that do not have access to municipal water supply for drinking and domestic use is a widespread phenomenon. Alarmingly, industries located in the same area are frequently reported discharging their wastes illegally into the underground aquifer and extracting high volumes of water for manufacturing purposes.

The officials interviewed for this study recognised the deteriorating status of the groundwater in the trans-Hindon area, but were reluctant to report this concern within their professional authority. In principle the Central Groundwater Board (CGWB) and the UPPCB share responsibilities and powers for monitoring groundwater pollution according to the Environment (Protection) Act, 1986. In reality, however, the allocation of responsibilities between the two authorities is fraught with contradictions. For the regional office UPPCB director, Mr. Jadav, the power of his office ends at the matter of

'industrial' discharge[138]. Once water pollution enters the groundwater, the regional office is absolved of any regulatory responsibility. Groundwater pollution and extraction, he further explains, rest with the CGWB[139]. The CGWB perceives its powers very differently. Historically, as Mr. Sen, the senior engineer of the CGWB, explained in an interview, the main focus is monitoring the 'quantity' of groundwater extracted as opposed to its 'quality'[140]. This is supported by the written responses of the CGWB that state that, regarding the pollution of the groundwater in Ghaziabad, the CGWB 'has not shared any responsibility' with the pollution control Boards[141]. This is surprising because the CGWB has classified the region as a 'critical' area where the groundwater is considered overexploited and therefore extraction of groundwater for industrial uses is prohibited[142].

Primarily as a result of the wider political economy driving change in peri-urban Ghaziabad, the problem of groundwater depletion curiously enjoys both a level of recognition and a certain degree of obscurity. State officials, scientists and citizens converge in their assessment that groundwater levels have consistently been falling. However this has not precluded the even greater efforts of citizens and the state alike to bore deeper wells in order to obtain fresh supplies of water. This is true of villages, affluent communities, businesses involved in the water trade and industries involved in the large-scale extraction of groundwater for industrial purposes. More importantly, as a result of the unprecedented growth in the district in terms of both commercial and residential uses, new pressures are being placed on an already constrained water source. Given that for many of the recently established middle-class colonies water is being sourced directly from the upper part of the river Ganga (see also section 5.1), in reality this is a problem that is affecting more severely the poorer communities that are not connected to the official water supply grid.

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[138] Interview with Mr. Jadav, director of the UPPCB regional office, Ghaziabad, 12 February 2010.
[139] Interview with Mr. Jadav, 12 February 2010.
[140] Interview with Mr. Sen, senior engineer of the CGWB.
[141] Information received from the Central Groundwater Board, 20th September, 2010, under the RTI Act.
[142] ibid, 22th September, 2010, under the RTI Act.

According to residents of KarKar Model village the problem started when the residential apartments and housing complexes started to grow in number but there was no matching expansion of water supplies by the municipal authority, the GNN, either in terms of treatment or provision capacity[143]. This has led to the rise of privately operated water plants for making bottled water. Those running these private plants see themselves as fulfilling an existing demand and at a rate that is much lower than the more famous brands of bottled water in the industry. Village residents therefore often buy bottled water in order to cover basic water needs. However, it is evident that the safety of bottled water cannot always be guaranteed, especially given the competing pressures on groundwater from industrial and other uses.

The case of groundwater deterioration is therefore to some extent distinct from other water quality concerns facing citizens in the area. Unlike the case of the river Hindon, where formal boundaries of responsibility are more clearly assigned (even if that makes little difference to the environmental conditions of the river), in the case of groundwater, formal boundaries are extremely blurred. Those in charge of water supply, such as the Uttar Pradesh Water Board, take water a certain distance, after which the municipal corporation takes over. However the municipal corporation sees its role as limited to ensuring the quality of water when it leaves the WTPs. The regional office UPPCB may have a role in groundwater protection, but as mentioned previously, whether responsibility is assigned to the CGWB or the pollution control authority still remains obscure, despite the fact that the deterioration of the groundwater has been ongoing for several years. Given that a significant proportion of the poorest peri-urban citizens are reliant on (increasingly polluted) groundwater, the inability of the bureaucracy to effectively manage this resource has become associated with a series of adverse environmental and human health consequences.

5.3.2. Citizen knowledge on water quality

The fact that groundwater quality remains an unaddressed concern is a starting point for peri-urban villagers to develop their own views of the causes and implications of worsening levels of water quality in the district. Unlike district officials and scientists who perceive water quality only in scientific terms, for citizens, water quality is a

[143] Interview with KarKar Model village resident, Sahibabad Industrial Area,12 March 2010.

concern deeply ingrained in their everyday lives. In many of the poorer settlements of the trans-Hindon, poor quality water is something that people have lived with for many years and its adverse impacts are felt in diverse ways. The 'invisibility' of poorer village settlements to the municipal water supply grid means that water tends to be accessed informally and from various sources (e.g. use of private tubewells is a dominant water access strategy in the villages visited); but the fact that these water access strategies take place in the absence of water safety measures means that the quality of these sources cannot be guaranteed.

Greater emphasis on citizen evaluations of water quality has an important place in moving beyond formalised risk assessment procedures that focus on narrow assessments of risk, towards assessments that recognise experiential sources of knowledge and their possible long term value in developing water quality protection policies (see also previous section 2.5 on responding to risk). Citizen accounts of water quality can also prove valuable for reconceptualising formal boundaries to deal with water quality (i.e. the boundary between drinking water quality and water pollution), and for adopting a different notion of scale that may possibly draw on both local sources (groundwater quality) and regional sources (river quality), and linking these to local practices.

Ambedkar Nagar, a slum settlement in the trans-Hindon, is an ideal case study of some of the long-term adverse consequences of ignoring the pollution of water sources near at hand, while relying on obtaining water from ever more distant sources. This informal residential locality is situated behind the Anand Industrial Area, and on the front side of the colony are situated the affluent colonies of Vasundhara and Vaishali[144]. The population of Ambedkar Nagar consists mostly of informal labourers, industrial workers and other citizens in subsistence occupations including artisans, craftsmen and street hawkers. This settlement had grown up in the mid-1970s when the Anand Industrial area began to take shape. Over time however industrial activities have increased within the estate, and alternative options for accessing clean water from nearby sources have diminished due to competition for water with the new residential complexes that have mushroomed in close proximity. Consequently, Ambedkar Nagar's residents have no

[144] The map of the trans-Hindon, in Figure 6, shows the relative proximity of Ambedkar Nagar to the middle class colonies.

other option than to resort to the use of groundwater; the fact that the groundwater in this locality is normally of inferior quality has created immense difficulties for the residents and as a result problems of deteriorating water quality come across quite forcefully in the citizen discourse.

Water quality in this locality is judged more frequently on the basis of citizens' own criteria, such as aesthetic considerations, colour and appearance, and far less on the basis of formally prescribed physico-chemical parameters. Interviews with residents of Ambedkar Nagar, which is a slum settlement, start with reference to its taste and colour and are overwhelmingly negative. In the popular discourse, water drawn from the groundwater becomes 'yellow' when left to stand for a few minutes, and its taste is 'acidic'. Because of this, the fact that water is not fit for human use is widely agreed and often caricatured using popular turns of phrase; 'For us water is a problem, even the utensils and jewellery are of no use to us!'[145] (referring to the damage caused to utensils from contaminants in the water). More senior community members that are familiar with the land transformations of the trans-Hindon region often talk about water quality in relative terms. In an interview from the same colony one member said 'before recent years, clean water was received from 30ft below, when at present submersibles need to be bored as deep as 120ft!'[146]. Reference to past memories illustrates the overwhelming impact industry has left on people's lives, quoting 'the river water was clean and potable. It was also used to cook food for marriage ceremonies, but during the last 20 years, the water quality has greatly deteriorated due to the polluting industries'[147]. The river Hindon was previously a source of fresh water linked to the agrarian fertility of the wider region, but is now widely referred to by the majority of social groups residing in the area as a 'sewer' for the urban towns, carrying an excessive load of industrial pollutants and pesticides released from the agricultural run-off of farms.

Shifting attention from a slum settlement such as that of Ambedkar Nagar to some of the village settlements located in the trans-Hindon suggests that the assessments of water quality are ultimately tied to how water is used for different purposes. In KarKar Model village, which is situated within the Sahibabad Industrial Area (see map of trans-Hindon, Figure 6), drinking water, among those who have the means to access a better

[145] Interview with older woman in Ambedkar Nagar, 15 March, 2010.
[146] Interview with old man in Ambedkar Nagar, 15 March 2010.
[147] Interview with old man in Ambedkar Nagar, 16 March 2010.

quality of it, is always used separately from groundwater, which is deemed 'acceptable' only for bathing and washing utensils and clothes. Groundwater is used for irrigation too and the use of pumps is reportedly very high. However, as one village farmer declared, 'the government does not recognise this as an agricultural zone any more, and therefore there are no official supplies of water for irrigation'[148]. Similarly, because the municipal grid does not reach village households, clean drinking water can only be purchased from private water suppliers. Figure 8 illustrates some of the different options available to village households for accessing water.

Given the relative ineffectiveness of district authorities in securing water access for the village settlements, the above division of uses that village residents have developed over time has to some extent helped them meet some of their basic water needs. However, it is evident from the citizen discourse that this largely informal system of water access has also introduced different sources of risk from impaired water quality. Residents from KarKar Model village, particularly women who are more regularly involved in household activities, complained that the direct use of groundwater for cleaning, cooking and other household activities has caused widespread problems for the residents, especially ailments like skin rashes, and hair falling out, stiffening and browning. Because there are no official supplies for irrigation, farmers have to resort to the use of water from the Hindon river. Given that the Hindon is highly polluted, the largely informal system of irrigation presents a number of water quality risks both to farmers and consumers of food crops due to the presence of toxins in the irrigation water (see also section 5.3.3). Bottled water, although perceived as a 'necessity' for those village citizens that can afford to buy it, also entails water quality risks because even though it is treated, it is obtained by private vendors from the same groundwater source that village residents have grown accustomed to using for their domestic needs. As with other instances of water quality knowledge, in the case of bottled water quality, sensation counts and the altered taste of water after it has been treated stands as a guarantee of superior quality. However, villagers are at the same time acutely aware that there is a difference between that water, which appears 'visibly' clean and 'good' to taste, and water which is effectively cleansed of its pollutants.

[148] Interview with farmer and resident of KarKar Model village, 7 March 2010

This brings the discussion to an important point of distinction between the 'citizen' driven assessments of water quality and the professionalised assessments emanating from the municipal authorities and pollution control officials. In citizens assessments the planning and policy driven distinction between the categories of 'drinking water' and 'water pollution' become blurred, water pollution and drinking water being part of the same discourse. In the surveyed localities of KarKar Model, Arthala and Maharajpur people told us in large numbers that despite their long-pending request and representations at various levels, the government has never provided their localities with any kind of underground sewage disposal system. In the localities surveyed, there is an open drainage system carrying waste, both liquid as well as solid. However, this network of small drains does not connect to any larger systematic network of waste disposal (as is the case of the middle class colonies), but instead empties into large cesspools of accumulated filth and dirt 'behind' or 'inside' the village boundaries. Consequently, when asked about water quality, people would respond in sweeping terms, and would say, 'Our village is surrounded by this water (implying wastewater); the village is a sick community since the water has turned poisonous'[149] to highlight that water and waste have become inseparable in the way water quality is perceived.

[149] Interview with Arthala village resident, 9 March 2010

Piped municipal water supply

Groundwater tubewell

Reverse osmosis technology

Figure 8: Modes of accessing water in the trans-Hindon

In Maharajpur village, deteriorating water quality is seen as part of a much more general exclusion from civic amenities: 'We are bound to live in filth and bad odour while our water is poisonous; in Vasundhara, the rich have clean houses and get treated water from the Ganga'. By contrast, the dominant presence of unregulated industrial wastewater is often a more serious concern. In Arthala village, situated close to Arthala Industrial Area (a more recent industrial estate under the control of the UPSIDC), industrial wastewater flooded the catchment area, leaving the groundwater completely exposed to toxic chemicals that have entered the shallow underground aquifer contaminating the village's only water source. As an outsider, I was frequently summoned to observe the yellow colour of the water coming from the hand pumps or invited for a walk around settlements to take a look at the large cesspools of excess wastewater. Ironically, some of the cesspits have been 'developed' by the municipal corporation and the Ghaziabad development authority, to build 'lakes' for recreation. Hence, a rather paradoxical situation has emerged where 'picnic spots' and 'boat ride' activities are available in the same areas that wastewater is being disposed of.

From the point of view of the citizens, the dominant presence of industries in their locality is yet another source of 'proof' that the drinking water source is polluted. This has led to a feeling of mistrust towards expert-technical judgments on the relative scale of pollution that is taking place in the district. Importantly, it has led to the belief that even though a formal mechanism for pollution control is in place, in reality this has made little difference to the communities. This was eloquently described in an interview with a human rights advocate: 'The same bureaucrats and engineers whom we suspect of giving sanction to the industries that pollute our water are in the so-called "expert committees". It is like giving the key to the thief'[150]. According to some residents, the fact that pollution is judged solely on the basis of standards serves as a political strategy for absolving regulatory authorities from any form of accountability. Sushil Raghav's impression, working as an environment and human rights activist, is that 'water quality doesn't necessarily need a scientist to understand it; you don't need the [pollution] Board to tell you the water is polluted'[151]. This citizen-led 'framing' of the regulatory mechanism reflects a broader citizen frustration with the dominance of standard based evaluations of pollution, and also confirms some of the problems with standard based evaluations that this study has explored in the context of the Board (see also section 4.4.2).

Citizen-led narratives on the failure of pollution control quickly move into discussions of the impact of water quality on people's health. Impact is inferred from general rashes on the skin, stomach disorders and skin lesions. On other occasions poor quality water is associated with more serious diseases such as respiratory and reproductive disorders, cancer, and even death. However, because of the invisibility of the relatively poorer residential colonies to official view (particularly the villages and slum settlements that are within industrial colonies), health effects are rarely validated through formal water quality assessments and are almost entirely based on people's experiences. In some cases, the impact of water quality on health is inferred from the death of animals such as cows and buffalo forced to drink the polluted river water. For some village residents it is a much more personal matter. For example, people frequently mentioned that deteriorating water quality had caused the loss of a family member from a severe

[150] Interview with Mr. Venkataraman, senior advocate, Indirapuram, Ghaziabad, 14March 2010.
[151] Interview with Sushil Ragav, environment and human rights activist, 19 March, 2010.

illness. On several other occasions, deteriorating water quality was linked to large financial expenditure incurred by families for medicines and hospital treatment to treat water-related illnesses.

5.3.3. Impact of industrial pollutants on water quality

The adverse impact of industry in the trans-Hindon is central to communities' assessments of water quality. In particular, interviews with villagers and slum dwellers suggest water quality is deteriorating for several reasons, industrial pollution being one of the more important ones. However, during interviews with government officials and pollution enforcement officials, this concern is usually played down. For instance, it is more common for the regional office UPPCB to associate impaired water quality with domestic sources of pollution (e.g. as a result of shortages in STP capacity) or distant sources of pollution entering the district (e.g. untreated sewage transferred from cities upstream), where regulatory accountability is weaker. Novel science and technology methods introduced in the sector are intended to lead the non-expert to believe that complete regulatory control of industrial sources of pollution will lead to zero discharge of toxic wastes. These solutions are also expressed at the national level, by the Board. The Board assumes the norm is for industrial pollution to be tackled effectively by pollution enforcement officials, a regulatory practice perceived to rest entirely with the State Boards and the regional offices immediately below them.

At one level, empirical insights from peri-urban areas contradict the official rhetoric about the scale of pollution problems in local contexts. In Sahibabad industrial area alone, the largest industrial estate in the district, there are 304 industrial units presently registered with the regional office[152]. But a large number of units are frequently reported to operate without the necessary environmental clearance (termed No Objection Certificate[153]), discharging effluents with minimal or no treatment directly into the drains and the river. The regional office UPPCB recognises only 15 units operating

[152] Information provided by the regional office, U.P. Pollution Control Board, Ghaziabad, under the RTI Act, 2005.
[153] The regional office monitors which industries are conforming to the pollution control norms by means of issuing a 'No Objection Certificate' (NOC). This is a written consent provided by the regulatory authority to the industry and proves compliance with environmental norms. The NOC's need to be reviewed by the regional office on an annual basis to check that industries are continuing to maintain their pollution levels below permissible limits. Industries that are running illegally or do not hold a NOC are assumed not to be complying with environmental norms.
[153] Interview with Mr. Jadav, director of the UPPCB regional office, 20 March, 2010.

without environmental clearance, although the real number operating without consent is understood to be much higher: closer to 140[154]. Some villagers claim that the real numbers are underestimated because pollution control officials can be easily bribed. A resident of Maharajpur village, for instance, found it suspicious that 'all officials working for the regional office UPPCB have a car', attributing the fact that pollution control officials are relatively better off to 'honour gifts' received from the business owners[155]. Moreover, the UPSIDC (the official body in charge of industrial areas) is considered to blame for 'knowingly' extending permission of operation to the worst polluting industrial units found in the district. (This is an argument that pollution inspectors would also frequently mention in their defence).

[154] Information provided by the regional office, U.P. Pollution Control Board, Ghaziabad, under the RTI Act, 2005.
[155] Interview with resident of Maharajpur village, Sahibabad Industrial Area, 22 March 2010.

Karkar Model village

Maharajpur village primary school

Figure 9: Urbanised villages within industrial zones

Villagers are perhaps the segment of the population most frustrated with the lack of enforcement of regulations. Many of these factories are operating both adjacent to, but also increasingly inside, the villages, see Figure 9. The latter include particularly dye and dyeing factories, electroplating and chemical factories that have been pushed out of Delhi as part of a larger initiative by Delhi's urban authorities to remove polluting industries from the capital (linked to the beautification of the capital). As a consequence, even though the pollution enforcement structures in Delhi and Ghaziabad (in terms of laws, prosecution procedures and so on) are similar, the implementation of rules and guidelines is, in practice, much more lax in comparison with Delhi. Partly because these operate on a temporary tenure, owners are not motivated to take long term pollution mitigation measures (see Figure 10). The lack of a robust mechanism for implementing regulatory norms in turn encourages a system whereby polluting industrial units can operate informally and with little adherence to environmental norms. It is also less understood that dye and dyeing factories, although smaller in scale than the sugar and paper mills, can be equally or sometimes even more harmful. They are extremely water-intensive in terms of their production processes and their effluents contain toxic chemical residues that can be harmful even in very low concentrations.

Untreated wastewater entering drains

Extraction of groundwater

Figure 10: Polluting activities of industries, Sahibabad industrial area

Water harvesting is sometimes discussed as an alternative policy measure that could be used by these industries to reduce the depletion of the groundwater and reduce water usage. However the risk of pollutants finding their way into water collected using water harvesting techniques is considered simply too high for regional office UPPCB officials to trust industries[156] to use these techniques. As explained in a meeting with officials, 'there was a case 17-18 years back when a 1 mm drop of a red colour chemical seeped in the ground water. The chemical was potent enough to turn a large volume of the ground water into a red colour; if industry owners are not aware enough of these risks, how could we possibly trust them with these techniques?'[157]. Because of the difficulties in introducing pollution abatement measures to some of the industries posing the greatest threats to water quality, pollution inspectors prefer to remove them entirely from their routine monitoring practices, on the basis that, ultimately, such industries can never conform to environmental standards.

What is therefore shared across the board (citizens and officials) is the perception that industry has much to lose from strengthening its pollution abatement measures. Owners of small industrial enterprises feel that they have been 'forcibly' relocated from Delhi, so in their view responsibility for environmental protection rests primarily with the state, partly because of its failure to provide them with an alternative site to continue their operations. Some of the arguments that industry owners elaborated upon during

[156] Officials would refer primarily to the dye and dyeing industry when discussing pollution risks associated with the use of water harvesting techniques.
[157] Discussion minutes from the STEPS peri-urban project meeting with Ghaziabad government officials.

informal interviews included, for instance, the failure of the state to provide any form of underground waste disposal system, and the lack of monetary incentives to industry for the use of 'eco-friendly' waste management techniques. Another argument mobilised by industry was regarding the miserable electricity situation of the region, as a consequence of which the factory owners felt unable to use technologies like ETPs in an efficient manner.

As a result, an extremely high pollution load on the water resources largely passes unnoticed by officials. It is common knowledge amongst villagers for instance that a large number of dye and dyeing factories pump polluted water directly into the ground via pipes, a practice used to conceal from pollution control authorities the true scale of waste produced from industrial processes. The main contaminants identified within the effluents of these industries include high levels of organic pollutants as well as high concentrations of heavy metals (i.e. from dye and dyeing industries). Quite often the levels of these contaminants in the river and groundwater are way beyond the permissible limits designated by the Board, as well as those designated by international organisations such as the WHO. For example, the level the heavy metal chromium in the Hindon river is 12 mg/l, 123 times higher than the Board's permissible limit of 0.05 mg/l (Lewis, 2007: 16).

Similarly high values are observed for metals found in the groundwater used for drinking purposes in poorer colonies in the trans-Hindon. In Arthala colony, lead is found in the groundwater in concentrations more than three times the permissible limits of the WHO (ibid). High levels of heavy metals are known to be highly persistent in the water column and not easily broken down or destroyed. They are extremely toxic to aquatic organisms as well as to humans, where long-term ingestion of water polluted with heavy metals can be devastating, leading to the development of a number of cancers, neurological disorders, and even death. Such health impacts are picked out by community respondents, environmental activists and the local media but rarely enter the official discourse. For instance, there are regular news clippings reporting the death of animals such as cows or goats that have consumed chemically -polluted water, but also stories reporting incidents where people's health has been adversely affected by

impaired water quality[158]. Despite several incidents being reported in the district, there are very few comprehensive studies evaluating the presence and extent of toxic pollutants in the surface and groundwater sources in the trans-Hindon, apart from a select few studies conducted by community-based organisations and locally-based environment NGOs (such as Janhit Foundation, based in Meerut district, Uttar Pradesh). Despite the opportunities presented for the use of this information in regulatory decision-making, environmental NGOs tend to operate antagonistically with regulators (this has also been explained in section 4.5.4).

[158] Source: selected media clippings on pollution in Ghaziabad district that have been translated from Hindi to English.

Wastewater irrigation, Karhera Village

Vegetable market, Sahibabad area

Figure 11: Water quality and the food system

In the trans-Hindon, the unregulated discharge of industrial wastes is also seen to pose significant risks to the food system. Not all villages have abandoned agricultural practices, but the scarcity of freshwater has led many farmers towards the irrigation of food crops such as cereals and vegetables with wastewater. Karhera is one of the oldest villages in the trans-Hindon, where agriculture still remains an important source of livelihood, but where farmers have become increasingly dependent on wastewater to irrigate their crops. Water from the Hindon, mainly consisting of domestic and industrial wastewater, is distributed to individual fields on a rotational basis. For the farmers, the use of wastewater is recognised as an opportunity to grow more crops faster since the high concentration of organic content in the wastewater is thought to act in a similar manner to chemically produced fertilisers. It is also more cost effective because it reduces farmers' dependency on chemical fertilisers[159], see also Figure 11.

However, it presents a number of risks to farmers and consumers of food crops since toxic factory wastes found in the wastewater bio-accumulate in the soil and crops[160]. This indirect health impact and livelihood dimension linked to water quality in the district is something officials are rarely interested in taking seriously. For pollution control authorities, both at the district and national level, wastewater re-use for agriculture is perceived more in terms of an 'environmental hazard' than as a source of livelihood and opportunity to promote environmental sustainability in the trans-Hindon.

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[159] From the point of view of environmental sustainability, previous studies have demonstrated the benefits of safeguarding (i.e. through policy and institutional arrangements) the informal use of wastewater for agriculture, see also (Scott, 2004).

[160] Studies have shown that levels of heavy metals such as Cadmium much beyond WHO and CPCB permissible limits in food crops irrigated with wastewater (cf. Marshall, F. et.al, 2005).

Therefore it continues to be treated largely as ‘informal’ and lacks the types of monitoring provisions that are already in place for rivers, streams and the groundwater.

5.4. Conclusion

This chapter has provided an in depth account of the ways in which water quality interventions are negotiated at the receiving end of formal policy. The trans-Hindon region in particular highlights the types of challenges associated with policy implementation in urban/rural contexts in times of rapid social, land and environmental transition. Unlike Board scientists who assume that water quality mandates are part of the ‘unbroken’ communication of policy objectives from the national through to the state and district level, water quality in the trans-Hindon is subject to different official practices and competing priorities for science and technology, monitoring and regulation.

Despite various arrangements to ensure the protection of water quality (both planned and already implemented), the official system fails to take an integrated view that balances a sustainability and livelihood agenda. From one side the urban authority and water department narrowly focus on a ‘piped water’ supply that caters mainly for the more affluent middle-class colonies (a focus officially endorsed through the installation of expensive WTPs and STPs), while on the other side, pollution control authorities focus firmly on industrial concerns (i.e. monitoring compliance of industries with environment norms). As a result, ‘unorganised uses’ of water may fail to enter the official domain, contributing to the depletion of the groundwater, the transformation of the river Hindon into a sewer, and the prolonged exposure of local populations to toxic pollutants that are harmful for human health.

This chapter has also brought to the foreground the contradictions between expert-led framing (and policy expectations) around the enforcement of water quality (namely those produced by pollution control authorities) and how water quality problems are experienced in peri-urban contexts. The dominant expert discourse on the causes of deteriorating water quality revolves around population growth and domestic sources, but in the discourse of villagers and slum dwellers it is a much more deeply rooted concern. The risks posed by industrial water pollution also exposed some of the difficulties put forward by pollution control authorities, which have inadequate

enforcement capacity and little executive power to close down the more blatantly polluting industries. Drawing upon the case study findings, the next chapter will discuss the mismatch between policy formulation and policy practice in more detail.

Chapter 6 Towards an integrated view of water quality management: a synthesis the two case studies

One of the arguments made earlier on in this thesis was that, in general, formal policy interventions to address water quality have failed to keep up with emerging complex challenges relating to the management of water quality in peri-urban areas. These failures are indeed evident from previous research on peri-urban environments, as well as from observations that have been brought together in this study, of the expert knowledge of scientists working inside government and of the implementation of policies in peri-urban areas. The main purpose of the following discussion is to elaborate on some of the underlying causes of this discord in the light of the thesis' findings.

The research emphasis on the Board in Chapter 4 explored in depth the role of expert advisors working from the point of view of environmental regulation. Specifically, the case of the Board demonstrated that a narrow emphasis on the 'technical' dimensions of water quality can be limiting in terms of integrating the complexities of impaired water quality in peri-urban situations. There is, for instance, little understanding of important pollutants or the way water quality risks are distributed unevenly, and particularly how they affect poorer citizens more adversely. The inability of the Board to take up a more integrated view of water quality is partly linked to the tensions involved in the framing of the Board's own policy advisory and regulatory roles. Section 6.1 of this chapter explores these tensions and further argues that because these are, on the whole, ignored by the policy and scientific community working for the Board and State Boards, it is difficult for policy agenda-setting procedures to take into account the emerging water quality challenges which are presented in peri-urban areas.

The thesis has also attempted to challenge the assumption that policy implementation is essentially 'top-down' and 'linear', by providing a more complicated picture of the relationship between the Board and various implementing agencies operating in peri-urban areas. The insights of this study contest conventional policy wisdom, which asserts that water quality management can be carried out effectively by implementing sector driven responses alone. At the local level, policy responses to water quality are tied to a host of institutions, but because areas where responsibilities could be shared

remain unclear, spaces of 'regulatory oversight' are created in the implementation of formal plans and programmes. The lessons learned from taking a closer look at procedures of implementation are explored in some detail in Section 6.2.

Drawing from a discussion of the problems and opportunities inherent in policy processes linked to water quality, section 6.3 contributes to a larger debate which is ongoing in India about the more recent measures proposed to improve environmental regulatory institutions. It argues that although 'administrative' reform can have a positive impact on regulatory performance in India, existing debates need to recognise the underlying causes of regulatory failure in relation to the functioning of expert advisory systems, as well as the value of incorporating 'non-technical' actors in the appraisal of different policy options.

Building on the various themes, section 6.4 concludes by outlining a series of features for an alternative approach to policy engagement with emerging water quality challenges. Attention is paid to the interaction between policy framing and procedures of implementation and suggests ways in which this could be strengthened to support more sustainable water quality management practices that can better target poorer social groups. The discussion concludes by returning to the conceptual framework in section 6.5, and elaborating on how this thesis has contributed to fostering a better dialogue between science studies and policy studies on the basis of the insights obtained from the two case studies.

6.1. The functioning of expert advisory groups

Turning first to the experts themselves, the interest of this study has been to clarify the precise cognitive and discursive mechanisms expert advisors draw upon to set water quality priorities. In particular, the research has focused on two areas of conflict in the Board's routine engagement with water quality where these mechanisms play a crucial role. The first relates to the way Board members contribute to the 'framing' of the Board's regulatory and policy advisory roles and the wider implications of this framing exercise (in section 6.1.1). The second relates to how the use of 'technical' arguments is implicated in the Board's efforts to present a certain type of knowledge that appears to be 'robust' and 'objective' but at the same time critically understates uncertainties surrounding a range of water quality problems (in section 6.1.2).

6.1.1. Framing assumptions influencing policy and regulatory practice

Examining the issue of framing first, the Board's regulatory and policy advisory roles are exemplified by two types of interrelated processes, the *assessment* of water quality that is linked to the Board's water quality monitoring programme and the *management* of water quality directly through the powers of regulatory action conferred to the Board by the Water Act. The 'official' mandate for the assessment and management streams is well documented and widely disseminated through the organisation's website and various policy reports. However, Chapter 4 provided insights into how scientists working from inside the organisation engaged with these different sets of activities. More importantly it followed the use of linguistic terms such as 'monitoring' and 'regulation' to demonstrate that these function as 'boundary defining' terms (Jasanoff, 1987) that tie the work of the Board with specific priorities and consolidate a particular allocation of power between the scientists, policy making and implementation bodies, and civil society groups.

In the case of monitoring, interviews with Board members confirmed that monitoring practices were often tied to the assessment of water quality at the river basin scale. This was presented as limiting significantly how complex water quality concerns indicative of peri-urban areas are able to feed into policy-making. Part of the reason for this mismatch was attributed to the scale the Board's national water quality monitoring programme was designed to address. Monitoring reports, for instance, made references to trends operating at the scale of the 'state' or the 'union territory' but engaged very little with identifying interactions across these scales. Official reports typically included 'approximate' estimates of domestic wastewater discharge in each of the cities a river passes through, but excluded more detailed accounts of different sources of pollution and direct effects on local contexts and specific regions. A distinguishing feature of the peri-urban realm is that impaired water quality has 'local effects', but also involves risks that are 'transferable' through movement of pollution, contamination of foodstuffs that are later sold in markets, and the interdependencies between local water contamination and regional water resources.

The framing of the monitoring strategy was further seen to influence in important ways how Board scientists created 'boundaries'[161] between their own assessment procedures and those pursued by other policy stakeholders. One area where the creation of boundaries played an important role was in separating the water quality assessments of Board scientists from alternative assessments emerging from civil society and environmental NGOs. This boundary separation rested on the assumption that regulators are perceived as those having the technical skills and specialised knowledge to 'evaluate' water quality, while civil society groups were envisaged as promoters of 'awareness' and citizen engagement. As a result, there were few entry points for civil society to gain any influence over the Board's water quality evaluation process. In peri-urban Ghaziabad, for instance, *Janhit Foundation* (a local environmental NGO) was instrumental in exposing the contamination of drinking water sources by heavy metals reaching the groundwater from industrial wastes. It was unlikely, however, that this information would be fed into the Board's decision-making procedures (see also 5.3.3).

Another boundary that emerged from the Board's framing of the monitoring strategy was in separating the 'biophysical' from the 'human health' effects of impaired water quality. Two problems emerged from this separation. The first was that there were few criteria (i.e. apart from total coliform which indicates faecal contamination of water) to measure 'direct effects' of water pollution on human health as opposed to the measurement of biophysical criteria that are a measurement of environmental pollution (such as BOD, pH and temperature). This limited from the outset the extent to which links between water quality and people's health can be drawn upon to influence policy decisions. For instance, in the peri-urban case study impaired water quality had serious implications for poorer citizens' health but often appeared to be left outside the official boundaries of district officials and pollution regulators. The second problem was that a separation between biophysical and human health priorities failed to recognise that, in practice, these two are interlinked. In the peri-urban case study, when the quality of the groundwater was not guaranteed, there were direct implications for the 'potability' of drinking water and consequently, for the health and well-being of those who depend on the groundwater. However, the links between the environmental quality of the natural

[161] Boundary work linked to scientists working in government technical organisations and regulatory bodies has come to be seen by many as the activity of demarcating science from 'non-science' (Jasanoff, 1987). The term is used here to explain how such boundaries were drawn between Board members and outside actors specifically in relation to water quality.

resource and the lives of the poorest groups were undermined in the regulatory framing of the Board because its mandate prioritised the biophysical aspects of water pollution, excluding from policy view the more critical social and human health dimensions.

In section 4.4.4 of Chapter 4, the thesis has also tried to demonstrate that the underlying reasons for the way such boundaries are drawn were not entirely based on the scientists. On the contrary, the framing of the monitoring strategy was also subject to external policy influences, regarding for instance the selection of sites that are allocated more robust monitoring. The convergence of urban environmentalism with concerns around river water quality meant that Delhi was at the forefront of the Board's activities (this was exemplified by the centrality of Delhi in monitoring activities, in transferring polluting industries to the peripheries and other measures explained in section 4.4.4). However, the restoration of water quality in the broader region of Delhi, which includes peri-urban areas, did not figure prominently in wider policy initiatives. More broadly, water quality restoration programmes were observed to reflect 'utilitarian' as well as 'political' motives; utilitarian because some water resources (particular the Ganges river basin or the Yamuna) mattered more as 'water reservoirs' for large cities and towns, but also political since judicial and civil society activism often played an important role in influencing the direction of water quality restoration programmes.

The framing of 'regulation' was driven by a different set of expert commitments. In particular, an important trade-off emerges between those sets of issues where the Board appears to have clear 'regulatory' responsibilities and those where regulatory responsibilities fall elsewhere or remain ambiguous. On the one hand, industrial water pollution was clearly perceived to fall within the Board's remit. On the other hand, the Board preferred to claim no authority over pollution impacts that went beyond the point of industrial wastewater discharge, or where policy interventions to address impaired water quality were viewed as more politicised or contested. A direct consequence was the omission of pollution cases affecting poorer settlements. Issues of wastewater stagnation and overflow, or contamination of the drinking water supply, emerged as major water quality concerns for poorer peri-urban residents, but nonetheless figured less prominently within national level discourses.

Another implication inferred from the Board's framing of regulation was that, in practice, responses to industrial water pollution were highly selective. Large-scale industrial units were prioritised in national environmental surveillance strategies while small-scale industrial units were underplayed. In particular, solutions to pollution caused by small-scale units were perceived to be simpler and often synonymous with a 'regional redistribution' (relocation from the city to the periphery) paradigm. This separation typically understated risks that were attached to less understood sources of pollution. Firstly, in peri-urban areas, dye and dyeing industries were seen to contribute significantly to the deterioration of water quality. And secondly, the way industrial pollution was framed suggested that Board members assumed the existence of a fairly robust regulatory structure operating at the local level, when in practice, regulatory norms were seldom met.

It is important to consider some of the political underpinnings of this framing exercise. At one level, the framing of water quality is the result of the Board's own attempts to maintain the 'status quo' of their organisation. However, what further complicates the framing of water quality are the politics that pull and push the Board's agenda. For instance, discussions with Board members illustrated that a particular framing of industrial regulation was not purely the result of science, but also partly of how industries were in a position to influence regulation. Similarly, complex bureaucratic politics often underpinned the particular way in which funds for monitoring were allocated between the Board, the MoEF, private enterprises, and municipalities. It was these bureaucratic politics that created a complex situation where 'blame' for obvious omissions in water quality protection was shifted between different agencies. Similarly, strong vested interests were involved (in national and city level contexts) in the selection of particular locations for strengthening measures for environmental protection. This partly explains why the problems of the periphery were consistently underemphasised in favour of Delhi based environmental issues. It is important, therefore, to note that the particular framing strategies which were observed are not solely linked to the fact that Board members wanted to strengthen the status quo of the organisation. These framings are further linked to how political pressure can be exerted from other parts of the bureaucracy, and the particular influence of various powerful groups in the decision-making process. The issue of framing is also addressed later on

in section 6.4.1, discussing measures for improving the effectiveness of the Board in its regulatory and policy-making roles.

6.1.2. Expert advisory processes and technical language

The empirical findings further support the view that an overreliance on 'technical' language to communicate water quality priorities became a limiting factor for problems affecting the peri-urban interface to gain sufficient traction in expert advisory appraisal methods. Two important issues emerged from this study with respect to the use of technical language. Firstly, that technical language was seen to avoid the inherent uncertainty and ambiguity surrounding a range of water quality problems and how these are experienced at the local level. Secondly, the multiple and sometimes competing discourses attached to water quality imply that 'technical language' has to be interpreted for the powerful barriers which it presents for *non-technical* knowledge linked to citizens' perspectives to be appropriately integrated into mainstream appraisal methodologies. The issue of technical language therefore needs to be considered in the light of the discussion presented in the theory section 2.5 on risk, uncertainty and ignorance, particularly in relation to the problems of expert risk assessments, to recognise uncertainty, sources of incomplete knowledge in the appraisal of risk, and the value of including alternative perspectives, such as those derived from the citizens themselves.

Turning first to the issue of uncertainty, a significant part of chapter 4 was dedicated to demonstrating that technical language (as reproduced in official texts and during interviews) is strongly linked to *power* precisely because it selects and enlarges particular framings, problematisations and policy priorities. From a discourse perspective, various themes were explored to demonstrate how this takes place in the Board. At one level, the disclosure of uncertainty was facilitated at a very early stage through the development of the DBU classification (see section 4.4.1) which created a picture of 'misplaced concreteness' (Stirling, 2011: 84) around what can be 'defined' and accurately 'bounded' within the Board's water quality evaluation framework.

Specifically, even though the DBU approach, as presented in official reports, suggested that water quality restoration was organised on the basis of achieving *desired human uses*, the range of uses recognised under the DBU were often 'misplaced' because they

suppressed the true diversity of water uses (and users) that are currently emerging fairly rapidly in peri-urban areas. Even in the case of clearly articulated policy arenas such as 'drinking water', quality is supposed to be guaranteed by *prior* treatment based on conventional technologies. But this definition was not realistic because it did not address the underlying difficulties in ensuring the quality of water when it is accessed without treatment or treated locally by informal methods and practices (private water suppliers and use of different treatment technologies are common in peri-urban areas). A powerful expert-driven assumption was therefore to reinforce aggregate categorisations of water quality (i.e. drinking water supply, irrigation, protection of wildlife and fisheries and so on) while removing the possibility of more diverse water quality evaluation scenarios being accounted for in policy. This in turn imposed crucial limitations on poorer groups, as their particular water quality needs were not sufficiently understood by Board members.

Exploring critically the use of technical language further confirms that the evaluation of 'risk' from impaired water quality was linked to exhaustive parameterisation exercises. However, the inherent indeterminate nature of parameterisation itself was often suppressed at the discursive level. Importantly, several contradictions emerged between the selection of parameters (and pollution load targets) and how these materialise in peri-urban situations. Frequently, *desired* targets are not met in the peri-urban context simply because they are too ambitious or because, in many instances, responsibilities for meeting such targets at the local level are blurred. This was demonstrated, for instance, in the implementation of the BOD target (an important measure of river pollution), where observable values in peri-urban areas were consistently well above the recommended limits set by the Board. Part of the reason for this contradiction was that standards for water quality are not reviewed systematically enough to be representative of local conditions. Of course, another limitation was that the same parameters encouraged a skewed emphasis on the evaluation of 'known' risks from water quality. However, risks characterised by incomplete knowledge and uncertainty, such as the health exposure of vulnerable groups to high concentrations of industrial contaminants (particularly heavy metals) found in the groundwater and water used for irrigation of food crops, were less apparent in the discourse.

The institutional imperative for objectivity reproduced through technical language was frequently at odds with the experience based discourse of citizens. Most prominently, the formal separations between different *uses* of water as the Board prescribes them had little direct relevance to how problems were perceived on the ground. Firstly, meanings attached to water quality by citizens are *subjective* and *context driven*. For instance, wastewater stagnation and overflow in the villages and informal colonies figured more prominently than water pollution at the river basin scale, and concerns around the potability of water were in turn rarely separated from the problem of wastewater surrounding settlements. Furthermore, sense perceptions such as taste, colour and appearance played a far more central role in the citizens' discourse than other technically derived physico-chemical criteria. For instance contamination of the drinking water source was affirmed on the basis of its colour and whether it turned yellow if left overnight. The legitimacy granted to technical knowledge, however, made it difficult for these sense perceptions of water quality to be reconciled with standardised descriptions of water quality promoted at the national level.

Moreover, the citizens' knowledge reflected that a more systemic exposure to deteriorating water quality of poorer citizens was strongly linked to their political and economic marginality. More affluent residents in peri-urban areas could override the contamination of local water sources by installing expensive household water filtration technologies. But the cost of treated water was prohibitive for poorer groups, and so they were directly reliant on polluted water sources for household uses. Also, as the peri-urban case study further demonstrated, their location in the district also exacerbated their marginality as poorer groups were often forced to reside in the immediate proximity of industrial sites. For these reasons, risk was felt unequally within the district. Closing the gap between agenda setting and implementation needs to address the fact that *unequal power* relationships can cause *unequal exposure* to polluted water, recognising that the underlying influence of power in turn suggests balancing 'technical' representations of water with the 'political', 'aesthetic' and 'experiential' representations. A further consequence of unequal power is that there are likely to be translations, interpretations and diverse modalities for action that are negotiated on a context specific basis. Policies are therefore not linearly adapted to the context (particularly a context that is under rapid transition such as the peri-urban). They are

translated, and power has an important part to play in the translation. It is to these translation processes that I will now turn.

6.2. Policy translations in the peri-urban context

So far, the discussion has focused on how policies are *framed* (and communicated) amongst the expert community of the Board. But water quality priorities were also *translated* through various local interventions and practices. Furthermore, these translation processes present several contradictions between the expectations of national regulators and the realities of their implementation. Examining only national level priorities and practices would not have been sufficient to demonstrate these translation processes, and importantly, how the poor are positioned in procedures of implementation. The other important finding is that translation processes involve interactions across a wider set of actors and institutions than those envisaged by national rules and norms, and that these interactions are in turn intrinsically shaped by relations of power. Interestingly, it is the less intuitive representations of power that influence quite considerably policy outcomes even though observed actors rarely articulated them in an explicit way.

An empirical observation that was of particular interest for understanding policy translation processes was that, even though the Board was directly involved in the reproduction of a broad range of rather ambitious regulatory targets, the enforcement of these regulations in peri-urban areas was usually far from impressive. This 'enforcement gap' has caught the attention of commentators in other transitional economies as well. In China, for instance, much has been written about the shortcomings of regulatory enforcement emphasizing that there are no simple answers. Observers of pollution enforcement in China argue that enforcement gaps are in reality the result of *multiple* and *interacting* influences including, for instance, fragmented bureaucratic structures, or the 'pro-growth' orientation of local authorities which is confounded by the 'pro-development' values of the enforcement officials themselves (Sinkule and Ortolano, 1995, Lo and Chung, 1998, Ross, 1998).

These observations have similarities with empirical observations from the peri-urban case study. However, at the same time the aforementioned commentators in China fail to consider adequately how power may be involved in the sustenance of such

enforcement failures. For instance, polluting industrial units that were deeply unpopular with local residents were able to maintain their operation and avoid prosecution except in relatively rare cases. The ineffective policing of industrial units in turn presented noticeable obstacles for water quality protection as it contributed to the deterioration of the groundwater from contamination and over abstraction for industrial uses. In addition, industrial pollution contributed to less 'visible' impacts, such as the contamination of irrigation water for food crops, and the environmental degradation of the local Hindon river. Another omission in the same literature is that 'enforcement gaps' are assumed to have an equal impact upon all populations, whereas the peri-urban case study clearly demonstrated that this is normally not the case as the impacts of weak enforcement tend to fall disproportionately on the poorest. Village residents and informal settlements situated within or adjacent to the industrial 'estates' found in Ghaziabad district systematically suffered disproportionately higher risks from water pollution than the more affluent colonies in the district.

The ability of industrial operators to exercise their powers in order to circumvent regulatory norms contradicted in many instances the rhetoric of effective industrial monitoring reproduced by Board members. It further highlighted several layers of complexity involved in the implementation of industrial norms and guidelines. Importantly, the rule of the 'state' (of Uttar Pradesh) over the 'district' meant that state-driven economic and industrial development imperatives often preceded a local environmental protection agenda. In the first place, industrial units with the support of the UPSIDC (the state industrial corporation that sanctions licences to industries) could operate in industrial estates where enforcement of pollution norms was less stringent. Secondly, the executive power of the regional office UPPCB to close down an industry that is not meeting regulatory norms became limited in these industrial estates. As it turns out, the way power was distributed between the state and the district facilitated a process whereby responsibility for decisions was passed back and forth between the 'state' and the 'district', thus removing accountability from the State for the most serious pollution impacts in peri-urban areas.

The demarcation between the 'official' and 'unofficial' realms of the district was further observed to reproduce unequal power relations. Particularly the way official boundaries were demarcated implied that there were fewer water quality checks in the poorer peri-

urban settlements. The Municipal Corporation (with the support of the water authority and the health department) carried out water quality tests at the point of water outlet (the water treatment plant) and at different stages of its distribution. These assessments were motivated by a clear policy goal to ensure the safety of the drinking water source, but as water quality assessments did not include water allocation practices that fall outside the formal water distribution network (water accessed using submersible pumps, water tankers, bottled water etc.) poorer social groups became even more exposed to risks of water contamination.

The propagation of unequal power relations was further linked to particular styles of official practice. The peri-urban case study demonstrated that, while water authorities, pollution control bodies and the municipality made extensive use of professional engineers, scientists, and trained administrative officers for performing complex tasks, decision makers in these lower ranks had a different way of prioritising the allocation of their services compared to experts working at higher policy levels. Board members, for instance, saw little disparity between social groups and regions in the way water quality monitoring strategies are carried out. But for professionals operating in peri-urban areas monitoring was strongly linked to their practical knowledge of the district (i.e. social status of different residents, types of settlements, geography, and access to municipal services) and was further shaped by moral codes and values.

Professionalism and expertise at the lower levels of the policy process therefore need to be understood in terms of the barriers and opportunities that they present for issues of procedural as well as distributive justice in the peri-urban. As was demonstrated in section 5.2.3 of Chapter 5, the labelling strategies employed to chart different populations within the district influenced in important ways how officials carried out their services. Because poorer settlements such as villages and slums were labelled as 'illegal' or 'non-conforming'[162], it was implied that the 'official' duty to respond to the particular needs of these poorer settlements was diminished. The director of the regional office UPPCB, Mr. Yadav, said in an interview, 'pollution exists in small pockets, not in the whole district'[163,164]. An important policy implication attached to this discourse

[162] Labelling terms that were also reproduced in the district's future development Master Plan (Ghaziabad Development Authority, 2006).
[163] Interview with Mr. Jadav, director of the UPPCB regional office, 12th February 2010.
[164] Referring to the industrial estates, but not recognising the villages situated in the estates.

was that higher pollution burdens observed in the poorer settlements were perceived narrowly as a direct outcome of polluting practices of the residents rather than as a failure of the State to reach out to the poorer groups.

It cannot be contested that the planning agendas pursued under Delhi's urban 'modernisation' paradigm have also helped shape in important ways the direction of development in the adjoining peripheries. In particular, as Pushpa Arabindoo explains, the 'metropolitisation' of cities of the Global South has clearly created a condition of inter-relativity between the core and its periphery (Arabindoo, 2005: 54). This is well revealed by the transformation that has affected the peripheral neighbourhoods of Delhi, which has marked a shift in the evolution of 'posh' neighbourhoods from inside the city boundaries, to peripheral neighbourhoods located in the immediate proximity of Delhi (ibid). The evolution of the elite residential locality of Vasundhara, in Ghaziabad also illustrates this, since it signifies where powerful actors of the city prefer to relocate. What is also evident is the growing need to keep the regulatory mechanism in the peripheries relatively powerless in order to support wealth accumulation within the city boundaries. This is evident from the changes happening within industrial zones such as that of Sahibabad, where an escalation of industrial activities (mainly informal in nature) have emerged at around the same period that Delhi authorities initiated policies to relocate industries from the adjoining capital. The fact that the state is unable to negotiate, or take a middle stance, in the conflict of interests ensuing from the growth of industries and the invasion of a more powerful urban middle class elite, means that environmental risks facing the previous older settlements are largely ignored. What this alludes to is that policy implementation failure in the peri-urban context has to be understood as being not only the result of policy negotiations taking place within peri-urban areas, but also related to how a much larger politics of 'exclusion' has come to shape urban development processes in India today (Fernandes, 2004).

6.3. Re-thinking 'failure' of regulatory institutions

Previous sections have highlighted some of the reasons why policy processes (and their reliance on expert knowledge) continue to fail to respond to complex environments and particularly to the needs of poorer groups. The empirical findings also reflect poorly on the ineffectiveness of environmental regulatory institutions (namely the Board and State Boards) in another way. In India, much of the debate on addressing existing regulatory failures has been summed up by a widely held view of implementation failure. The core of this argument is that, to ensure sustainable development (water quality being an integral part of this mandate), policy makers have to address the poor implementation and enforcement of environmental rules by the prevailing regulatory institutions.

There are two important, yet to some extent separate, voices in this debate. The first is tied to expert committees set up by government over time to review the functioning and performance of the Board and State Boards with a view to providing recommendations for their more effective functioning. In these reports, including the *1984 Bhattacharya Committee* report, the focus has been on fairly mundane aspects of regulatory performance, such as measures for improving the structural organisation and day-to-day function of the Boards, the creation of technical, scientific and legal service divisions in the Boards, and the generating of new funds to strengthen regulatory performance (CAG, 1992).

More recently, a renewed emphasis on the Boards can be noted with the publication of the report of the *2008 Parliamentary Committee on Science & Technology, Environment & Forests.* In this report, the recommendations challenge much more directly the overall capacity of the Boards to tackle pollution effectively. Problems of lax monitoring and non-compliance of polluting units in the different states are noted, as well as the declining institutional authority of the Board as a leading pollution enforcement institution (Parliament of India, 2008). A common feature of these reports, and others that have not been mentioned, is their recurring emphasis on the weakening power of the Board and State Boards to enforce regulatory norms and stipulated guidelines.

The second more critical voice of regulatory failure comes from civil society organisations that have, at different times, been fairly critical of the role of the State in tackling pollution. In civil society critiques as well, the need to improve regulatory capacity (by recruitment and training of technical staff) is recognised, but often superseded by deeper concerns about malpractices and lack of overall transparency in the functioning of the Boards (CSE, 2009). In the recent study of the Board and State Boards conducted by the public interest research group *Centre for Science and Environment* , poor performance is attributed to issues such as 'lack of staff', 'corruption', and 'poor regulations' as well as a general lack of willingness on behalf of regulators to disclose and disseminate information (CSE, 2009). It is also much more evident from these criticisms that by and large, public perception of regulatory performance is negative, and there is increasing public distrust of the present functioning of regulatory institutions.

The way causes for regulatory failure are commonly gauged both by civil society and government-led expert committees takes for granted in the first place issues around the design of regulatory approaches and the fact that these remain, at their core, very technical. The thesis' findings have demonstrated that, because of the nature of the Board's monitoring practices and definitions used to address water quality, local effects are excluded from more focused policy attention. With the policy emphasis being skewed towards the 'science' of regulation, decisions and choices that are not always based on science alone are not recognised. This was demonstrated for instance in section 6.1.1 of this chapter, which examined the framing assumptions influencing Board scientists' regulatory and policy advisory roles.

The second area of oversight in this debate is that opportunities for extending the participation of different stakeholder groups in regulatory procedures remains rather limited. The debate recognises the value of increasing the participation of community organisations and civil society representatives (Parliament of India, 2008), but it does not recognise that the knowledge of these stakeholders is likely to be considered less powerful than the prevailing technical knowledge. In section 4.5.2 of Chapter 4 for instance, it was demonstrated that the ability of different stakeholders to liaise with regulators is at least partly influenced by their capacity to 'speak the language' of the regulators. Industrialists invest in resources and consultants to perform complex water

quality tests, but those groups exposed to pollution who articulate their concerns in more subjective ways pass by, on the whole, unnoticed by the regulatory institutions.

On a different level, the peri-urban case study demonstrated that there is a need for ongoing debates on regulatory reform to look beyond the role of the Board and State Boards. These regulatory institutions do not operate in isolation but in fact are part of a broader chain of actors and institutions. This involves a complex interplay between the routine operations of regulatory bodies and other official agencies, and as a web of activities and practices taking place informally at the local level. Taking these inter-relationships seriously means that improving regulatory performance is likely to depend on more than just 'administrative' reforms, but also to a much greater extent on developing much clearer definitions of the roles of multiple actors involved in regulatory processes.

More recently, the same debate appears to have taken another turn with a proposal by the MoEF for establishing a new National Environment Protection Authority (NEPA) (MoEF, 2009). Within a broader set of reforms aimed at restructuring environmental governance in India, NEPA is anticipated to supersede the role of the Board at the centre, becoming the leading authority for pollution control and enforcement, while State Boards continue to perform the same roles at the state level (MoEF, 2009). Although much is still being discussed about the precise roles and functioning that NEPA may adopt in the future, it appears that many of the core problems identified as part of this discussion on the effectiveness of the Board and State Boards will be replicated with the inception of NEPA. In particular, the fact that the appointment of NEPA members is still largely based on science, and the fact that local interests remain largely unaddressed, are critical issues that are not sufficiently challenged in mainstream policy thinking. For these reasons observers of recent developments have argued that there is an obvious danger with the inception of NEPA in reproducing yet another technocratic model that fails at its core to be receptive to the deeper changes that are needed for improving regulatory performance (Lele *et al.*, 2010).

6.4. An alternative approach to water quality management

As discussed in the previous section, the causes of regulatory failure are several and this thesis has outlined at least some of the important discursive and institutional factors underpinning regulatory failure. By recognising the limitations of current approaches for addressing worsening levels of water quality in peri-urban areas, it is possible at this point to suggest features of an alternative approach to water quality management. The thesis has demonstrated that two processes drives existing limitations. The first is the framing of the policies at the national level, and the implications of these framings for policy practice, which is empirically grounded in the functioning of the Board. The second is the translation of policies in peri-urban areas and the influence of local actors and institutions in procedures of implementation. Of course, these are interlinked, and existing failures are encouraged by how the interaction between policy framing and implementation has taken shape. An alternative approach that is more effective and allows for greater preparedness in facing complex water quality challenges is therefore based on increasing the effectiveness of both these processes.

6.4.1. Increasing effectiveness of the Board

On the functioning of the Board a number of suggestions can be made as to how the involvement of expert advisors at the national level can become more constructive. The first area of improvement relates to the type of water quality problems that are normally covered in the Board's own assessments. At the moment, there is too much emphasis on pollution having an impact on river basins at a national level, where there is little space for alternative water quality priorities to feed into the decision-making process. This study however has demonstrated that water quality in peri-urban areas encompasses several dimensions, and that there are 'direct' local effects on the environment as well as adverse impacts on human health, particularly affecting the poorest communities. On the other hand, impaired water quality has 'indirect' effects as well when risks are transferred through the soil, the food chain, and the movement of water pollution to other locations.

Diversifying water quality assessment procedures to include these different dimensions can be resolved partly by accommodating different styles of expertise. However, the fact that at present the appointment of Board members is biased towards sourcing experts with engineering or physical sciences backgrounds makes the inclusion of alternative sources of expertise neither possible nor desirable for the organisation. One solution to this problem would be to review the schedule of appointment of Board members (as prescribed in the Water Act of 1974) so that the inclusion of experts from different disciplinary fields is made mandatory. For instance, at the moment, there is very little space for social scientists to be appointed in regulatory positions even though this would make it far easier to integrate into regulatory decision-making the concerns of individuals and especially local communities that are more adversely affected by pollution.

A further limitation which is partly linked to the way the Board sources its expertise is that, despite the links between drinking water quality, health and the environmental quality of the natural resource (i.e. water bodies such as rivers and groundwater), much of the water quality assessment process is currently designed to capture pollution impacts at the point of discharge of pollutants, leading to an over-simplified representation of risk. An assessment mechanism that encompasses cross-sectoral linkages could be developed through a more plural engagement of regulatory institutions with science. This means that pollution assessments are not only based on engineering knowledge but also on in-house expertise in other science based disciplines, including for instance environmental health specialists, ecologists and environmental scientists and those with practical experience in conservation. Furthermore, the appointment of a broader range of specialisations should not be confined to the Board only. For a more holistic approach to addressing water quality, these appointment principles need to be cascaded down to the State Boards and from there to regional and district pollution enforcement agencies that at present are structured on the basis of replicating the Board member recruitment model.

Another area where there is significant scope for improvement is in the way the Board manages its own boundaries with respect to its policy and regulatory mandates. The fact that the Board has accumulated powers in the areas of policy advice as well as regulation has put scientists working from inside the organisation in a curious position

where they have to fulfill both a technical and a political role. The capacity of the Board to function as a regulator is likely to be more complicated in the future if plans for the inception of NEPA go ahead as planned, and there is considerable uncertainty about how powers will be divided between the two agencies. If the Board is to maintain joint powers of regulation and expert advice their engagement with water quality issues will need to be much more transparent and accountable to the different stakeholders.

One of the prerequisites for increasing transparency is for Board members to recognise that unequal power relations and issues of procedural and distributional justice influence the implementation of regulatory rules and norms in important ways. The fact that industrial pollution in peri-urban areas is weakly enforced is not solely an outcome of administrative inefficiency. There are power relationships that prevent closure of extremely polluting units and prevent the formal system from being held accountable for the risks from pollution that are affecting the poorest citizens. The dominant narrative of expanding wastewater technologies and increasing administrative capacity, currently viewed as the only possible policy intervention for removing existing regulatory failures, is therefore insufficient and suppresses the true underlying complexities involved in resolving regulatory problems in local situations.

Greater transparency also needs to be matched with a more pro-active engagement with regulatory institutions operating at the local level. As it stands, monitoring water quality standards is left entirely to the State Boards and their subsidiary bodies (i.e. regional, district and city offices). This was supported by the discourse of regional pollution officials in the peri-urban case study, who regularly pointed out that any practical influence of the Board in the district was narrowed down to the remark that officials were following (at least in principle) the Board's water quality standards framework (see also section 5.2.1). It was therefore hardly surprising that a gap was noted in this study between the setting of a pollution standard and its enforcement in peri-urban areas. If the Board is to strengthen its leadership roles in pollution control it is therefore important that more opportunities arise for dialogue and interaction with local level officials and departments. Part of the reason why policy responses to the peri-urban repeatedly fail is that this interaction does not exist, resulting in the development of pollution abatement targets that are not realistic, and that reinforce an official logic of pseudo-adherence to universally applied norms and stipulated guidelines.

The research has also confirmed that, at present, there are few opportunities for civil society organisations and citizens to intervene in the regulatory process in a meaningful way. The main route available to citizens for influencing regulatory outcomes is through the formal complaint procedure. This mechanism presents a number of barriers. On the one hand resolving a citizen complaint can take a very long time because responsibility for action is shifted back and forth between the Board and State Boards. And furthermore, it does not provide sufficient scope for non-technical descriptions of pollution impacts to have the same level of legitimacy as those that are produced using the Board's standard methodologies. Similarly, at the moment there are a considerable number of environmental groups and NGOs working in India that are not well represented in the Board's decision-making process. This is particularly because Board members view NGOs in terms of fulfilling the role of 'watchdogs' of pollution and less for their scientific input. Thus, for raising the profile of 'unaddressed' sources of pollution the relationship between civil society groups and regulators remains largely antagonistic (see also section 4.5.4). The Board's capacity to reach out to more vulnerable populations and areas could be significantly improved by creating entry points for civil society groups to be more involved and actively participate at different stages of the decision-making.

6.4.2. Features of an integrated approach to policy implementation

The case of Ghaziabad district presented a complex scenario of policy implementation whereby water quality priorities are fed into a diverse host of institutions that includes the pollution control boards, but also extends beyond them. The relationship between the various institutions was largely fragmented and the implementation of policies dealt ineffectively with the complexities of peri-urban areas (associated with the formal oversight of a number of risks from impaired water quality). Given that there are these fundamental problems with the current water quality management approach, it is important to reflect upon some of the alternative options for making procedures of implementation more integrated and responsive to future sustainability challenges and the needs of marginalised groups.

Interestingly the peri-urban case study demonstrated that worsening levels of water quality are sustained not simply because of a shortage of formal interventions but more importantly perhaps because of the wide separation that exists between the different

interventions already in place. Ensuring drinking water quality was at odds with protecting water quality from pollution even though the two are interconnected in important ways. Similarly, the groundwater authorities took no direct responsibility for the pollution of the groundwater. This responsibility was assumed to lie with the pollution control authorities even though pollution enforcement officials saw no obvious responsibility for the depletion of the groundwater. The apparent disconnectedness between formal institutions was seen to undermine the sustainability of the region. Part of the reason for this distortion was because the integrated nature of contemporary water quality problems has simply not yet caught up with the role of officials who have accumulated powers to execute policies.

This problem relates back to the way policies are administered by central and state government through to specific areas. Policies are administered for specific sector driven concerns such as wastewater management, industrial pollution, and water supply. From the official point of view however as long as progress on specific sectors' projects is being met, the incentive to foster linkages with other sectors is almost made redundant. This was demonstrated, for example, by the case of the Uttar Pradesh Water Board engineer who was in charge of a wastewater treatment plant yet saw little connection between his work and that of the pollution control boards (see also section 5.2.2). In order for policy implementation to be more effective these interconnections and competing logics need to be made much more explicit. Otherwise the fact that there is a plurality of formal arrangements can work negatively because formal stakeholders do not properly understand the synergies and contestations between them.

So in one sense the peri-urban case study supports that there is a strong case in favour of fostering knowledge integration amongst formal actors involved in procedures of implementation. However, knowledge integration has to be balanced with a deeper understanding of the power asymmetries influencing policy implementation. One important structural change in the way decisions are executed at the local level in order to redress this tendency is to include those spaces and settlements where the poorest sections of society live and work in the implementation of formal plans and programmes. Rather than viewing the spaces where the poor live as illegal (as per an official discourse that excludes the poor quite early on from the implementation of policies), a revised approach towards implementation needs to recognise the

complementarities that exist between the quality of life of the poorest groups and the sustainability of the local region, and that populations in both formal and informal settlements live in parallel.

At the moment much of the focus on service delivery in terms of water and environmental services is on the more affluent settlements. In these areas drinking water quality is ensured by the official piped water supply; wastewater stagnation and overflow is prevented by the installation of a sewerage network and wastewater treatment technologies, and industrial water pollution poses a less serious threat since industrial activity takes place a fair distance from the affluent colonies. Such basic provisions need to be ensured for the poorer colonies too, but it must be recognised that the approaches needed are likely to differ significantly. Reducing exposure of the poorer groups to impaired water quality means that the reach of regulatory regimes needs to be extended towards these areas where polluting activities are more concentrated. Similarly, locating factories should be carried out with greater involvement of affected communities, instead of the current approach where new factories are introduced without consulting those citizens that are likely to be more exposed to environmental hazards. Another misunderstood dimension of course is that infrastructure development will not be the same as in the case of the affluent colonies. Affluent colonies in peri-urban areas are usually modernised, with wastewater treatment technologies fitted in advance of construction. In the case of poorer village settlements, installation of these technologies is constrained by a number of factors, including availability of space and the high costs associated with their installation and maintenance, as well as the fact that many of the houses within these settlements are ‘unconnected’ to the sewer lines and water supply pipes. Therefore in order for infrastructure development (aiming to address impaired water quality) in these sites to be effective, innovative technological solutions have to be considered in conjunction with informal technical interventions that are already in place.

Informal water access practices are, at the moment, consistently undermined in routine water quality checks. This has an impact upon basic survival strategies of the poor such as in the case of accessing drinking water, but also on water that is used to generate livelihoods, such as in the case of wastewater re-use in agriculture. As a result there is very little information in the public domain and amongst officials on how risks from

impaired water quality are having an impact specifically on poorer groups and how these risks may differ from those of populations that reside in the better-regulated colonies. This is a gap that is filled periodically by civil society groups through their own water quality studies, but it is not a sufficient measure for capturing the range of problems in all their complexity. There is a need, therefore, to foster greater transparency within existing regulatory institutions around how water quality monitoring takes place in practice, and how the vested interests of various policy actors can influence which locations receive greater recognition and tend to be better represented within formal policy mechanisms.

6.5. Bringing together STS and Policy Studies: insights from the case studies

One distinguishing feature of this study is the way that it has drawn upon both Science and Technology Studies (STS) and policy studies to derive its main insights. This is important for several reasons. The first point relates to the context in which research following these two analytical traditions has largely taken place. That is primarily in Northern settings, whereas as this study has demonstrated, a more critical analysis of policy processes and the role of science and technology can be of potentially enormous value in developing countries as well. It is important to note that some studies that have applied these traditions in developing countries have examined issues such as soil degradation and the governance of water resources (cf.Scoones, 1999, Mollinga, 2008). However, there is relatively less written on pollution and the influence of governance and policy contexts in shaping patterns of pollution, exposure and distribution. This is a gap that this study has attempted to fill by examining policy processes specifically tied to the escalating problem of water pollution in peri-urban India.

The second point relates to the type of synergies and interactions that can be fostered by combining these two analytical traditions. The theoretical discussion, in Chapter 2, presented a number of key themes that tend to preoccupy theorists of each tradition. STS scholars have demonstrated that expert knowledge systems are not ‘static’ systems; rather such systems tend to be highly dynamic and shaped in important ways by the social, political and institutional context in which these systems are embedded (Latour, 1987, Jasanoff, 1990). This dynamic view of expert knowledge proved to be particularly

valuable for understanding the work that is carried out at the Board. In particular, on the basis of an STS frame of inquiry, the thesis developed alternative explanations for why policy interventions fail to address peri-urban water quality concerns. In line with the conceptual framework presented in Chapter 3, section 3.1, the influence of conceptual categorisations such as that of the DBU was highlighted, along with the relationship of the Board with other actors (and how these relationships are dependent on how power is negotiated between different actors), and the fact that the overriding interest of Board scientists to maintain the 'status quo' of their organisation may pose a critical barrier to peri-urban water quality concerns receiving greater priority within national level policy circles. Given that much of the current research on peri-urban environments has adopted a 'place based' approach to examining the environmental degradation which manifests in these spaces, an STS perspective has also been valuable for demonstrating that a national level view of such problems also merits analytical attention.

The policy process 'frame' of analysis helped demonstrate that both policy agenda setting procedures (where national experts have a more influential role) and procedures of implementation (notably those which are manifested in the peri-urban context) are important for understanding why expert systems commonly fail to improve water quality. In particular, a policy process frame helped trace the particularities of the 'peri-urban' context in the analysis. It helped highlight the specific nature and processes of marginalisation that take shape in a local context. Undoubtedly, the current shape of urbanisation in India has encouraged an elite driven response to urban service delivery, and has also led to the displacement of polluting activities to the peri-urban context. This was illustrated by the fact that in Ghaziabad, it was often the middle class groups that were better protected by sewage and water treatment infrastructure, while the peri-urban poor residing in villages and slums were rarely recognised by the authorities. Furthermore, the centrality of examining discursive processes of knowledge creation, which is so central to the policy process frame, helped illustrate that policy implementation is not linear; rather it is influenced by how competing values, interests and priorities are negotiated in the policy sphere.

Table 3 outlines how elements of both frameworks are combined in this thesis to counter the respective weaknesses of the other approach:

Theme	***STS***	***Policy Process***
Critical engagement with scientific practice & culture	Strong	Weak
Taking into account micro and macro level policy spaces	Weak	Strong
Comparing policy 'agenda setting' with 'implementation'	Weak	Strong
Understanding suitability of technology to context	Strong	Weak
Thinking about power & knowledge	Weak	Strong

Table 3: Bringing together the 'STS' and 'policy process' analytical frameworks

6.6. Conclusion

The discussion of the two case studies has proposed several arguments that reveal processes through which expert-led policy approaches fail to address impaired water quality in peri-urban areas. The various themes that have been touched upon have made it clear that specific shortcomings in water quality management should not be viewed purely in terms of the resource constraints (i.e. shortfalls in financial, technological and human capital) that make policy responses to the peri-urban ineffective. These do matter of course, but perhaps behind the critical failures identified in the policy process are deeply embedded practices linked to the actors concerned (scientists, peri-urban officials, those exposed to impaired water quality and NGOs). These insights relate both to how policies are imagined in the first place and the role of expert advisors in shaping such dominant approaches, but in equally important ways the working routines of implementing institutions (exemplified by the role of officials working in peri-urban areas) can indirectly shape policy outcomes too.

Specifically, in the case of the Board and State Boards, making such regulatory institutions more responsive to the concerns and aspirations of poorer people means they have to tackle the interactions between power and different forms of knowledge,

directly from the level of policy framing through to implementation. At present, the dominant discourses that are seen as influential in shaping priorities for water quality management inherently de-politicise the problems and leave little space for citizens' concerns to be fed into the mainstream appraisal methodologies and monitoring plans. Even at the level of existing debates in India, interpretations of regulatory failure explored in section 6.3 remain, to date, too closely aligned with a dominant narrative of weak enforcement capacity linked to the Board and State Boards. Strengthening enforcement capacity is, however, only part of a possible solution and needs to be balanced with deeper structural changes such as the integration of different bodies of knowledge and the more direct involvement of regulators with social groups directly affected by formal decision-making. These changes can only take place over the long term, but are significant for moving towards more sustainable water quality management practices.

These observations conclude the analysis of the findings. The next chapter will address the thesis' concluding remarks. It will attempt to summarise outcomes of the study in relation to the overall research questions, outline the thesis' contributions and provide a set of suggestions on how research in the field could be expanded in the future.

Chapter 7 Conclusion

This closing chapter returns to the research questions posed at the start of this thesis and attempts to answer them directly, based on the analysis of the two case studies (in Chapter 4 and Chapter 5) and the subsequent discussion which looked across the two cases in detail in Chapter 6. The structure adopted is as follows: Section 7.1 puts forward the overall research questions and summarises the key arguments of the thesis. Section 7.2 explains what sets this study apart from previous research engagement with water quality, and its contribution to broader theoretical debates. Section 7.3 concludes the thesis by pointing towards directions for further research. These emanate from recognition of the limitations of this study and imply a forward-looking vision of how research can be advanced.

7.1. Answering the research questions

In seeking to investigate why expert-led policy processes fail to address the seriousness of water quality deterioration in peri-urban areas, the overall research questions that have motivated this study have been:

> *Why are problems associated with deteriorating water quality in peri-urban areas frequently neglected in expert-led policy processes? And what are the implications for peri-urban poor communities?*

Despite the empirical findings drawn from this study, answers to these questions still remain far from simple. Causes of expert-led policy processes failing to deal effectively with complex peri-urban situations and the particular concerns of the poor are several and highly interconnected. Indeed, a part of the answer needs to be traced back to historical accounts of the policy process in order to ascertain why science has come forward as a powerful discourse on the planning and management of natural resources. This is not an accidental paradigm as science scholars would argue, but rather it has been shaped by mutually reinforcing political, institutional and social factors (some of which have been addressed in more detail in Chapter 2). What this study has tried to show, however, is that even in mundane and apparently scientific domains of policy engagement such as that of water quality, contemporary realities bring about a need for a more significant involvement with the sciences, and perhaps, more importantly, stress

the urgency for developing a better balance in formal decision-making between scientific sources of expertise, alternative perspectives emanating from the citizens themselves, and also less well represented specialisations and disciplinary approaches (Wynne, 1996).

But a better appreciation of how science interacts with policy is only one side of the argument. A far less obvious dimension of the problem is the process of translation, reconfiguration and acceptance of deep-seated scientific framings by a diverse host of actors and institutions. When hegemonic frameworks of policy action (informed by science) are scaled down to peri-urban areas, positive outcomes across all sections of society can never be guaranteed, and certainly not for all the water quality problems that affect peri-urban areas. In this case, answers lie in the details of policy implementation and how current procedures can, in fact, operate in ways that reinforce social and environmental injustices. The thesis has tried to show that the precise mechanisms through which a policy approach that is largely expert driven and excludes the interests of the poor is shaped by mutually reinforcing *cognitive* (dominant policy knowledge influenced by science) as well as *procedural* processes (official practice influencing policy implementation in peri-urban areas).

This research has described, in detail, how powerful actor groups have come to shape these processes in order to advance particular interests. It has further identified a range of political barriers which have come to detract attention from how water pollution impacts upon the peri-urban context. To be specific, two kinds of political barriers have appeared to play a prominent role in the case studies examined. The first order of political barriers relates to the shortcomings of bureaucratic functioning. Different bureaucratic agencies pursue different interests with respect to water quality protection. However, better integration of a water quality protection mandate ‘across’ the bureaucracy was jeopardised by the fact that a high concentration of scientists with technical backgrounds still tends to dominate key administrative positions. Furthermore, although wider stakeholder participation was recognised by key actors in the policy process, in reality this was only at the level of rhetoric. For instance, engagement between the Board and stakeholders from the peri-urban case study was limited, and this was partly because of the very high level of ‘entrapment’ of regulatory processes by a much more powerful political and industrial lobby, which helped provide immunity to

industries that had not taken any measures to mitigate their pollution impact. A second order of political barriers relates to the fact that the state has an overriding interest in developing its periphery in the same way that it has developed its metropolises. A narrative of 'modernisation', which is in tune with the pursuit of neoliberal planning policies, provides therefore little prospect for the recognition of heterogeneity in peri-urban spaces, or of the fact that not all social groups have the same kind of political representation in development processes. As a result, while middle class groups have achieved a certain level of protection from environmental hazards, poor people have to fend for themselves with little or no protection being provided from state actors. Lastly, it is important to note that such kinds of political barriers are not meant to be exclusive, but rather the point is that these barriers have played a central role in the case studies examined, and occur at different scales of the policy process almost simultaneously.

Some reflection and clarification is appropriate at this stage on how answers to the questions posed were developed, both in the course of the research, as well as in the final written version of the thesis. In this study, the two cases that were selected, namely (a) the functioning of the Board and the (b) translation of water quality priorities in the peri-urban region of Ghaziabad, were central to the 'multi-sited' research approach of this study which hoped to capture and enlarge on a contemporary phenomenon in its real context. Using two case studies can be viewed as a somewhat ambitious way to answer the research questions.

The peculiarities and the difficulties that this thesis encounters in the delineation of multiple epistemological paradigms are illustrated in its borrowings from two different yet parallel discussions; the first pertaining to STS and the other to the peri-urban debate. Neither of these debates is incorporated here in full as this thesis operates on the points of intersection and interaction of those discussions. Despite the methodological limitation of not offering an in-depth coverage of either debate, the thesis explores the breadth that can be covered by simultaneously engaging with both in order to draw different conclusions and steer them to different outcomes through the discussion and the findings that are presented in the course of the thesis.

What therefore sets this research apart is that it has attempted to take on together these two very different discussions and to show how each context influences the other in

important ways. This approach offers a more multifaceted answer to why expert advisory processes neglect issues of water quality in peri-urban areas, an answer that includes both the operation of scientists and the direct implications of impaired water quality in local contexts, in a way that would not have been possible if it had been focused only on one of these policy settings.

The multi-sited approach adopted for studying the policy process demonstrated that making expert advisory processes of decision-making more responsive to peri-urban areas necessitates the reversal of a set of dominant tendencies. In the case of water quality assessment, there is significant scope for 'branching-out' assessment methodologies and promoting the inclusion of alternative sources of expertise. The fact that water quality assessment procedures are informed by a narrow range of expertise and perspectives provides limited scope for complex interactions between different water user groups and their existing dependencies on natural resources to be properly accounted for in policy making. Another tendency that could be reversed is the way poorer user groups are currently represented in policy appraisal and implementation procedures. A better representation of these poorer user groups affected in more adverse ways by polluted water is likely to depend on a better recognition of existing power asymmetries in implementation that exclude the concerns of the poor. Also, the development of meaningful interventions is strongly dependent on recognising that poorer user groups are affected by deteriorating water quality through a combination of 'formal' and 'informal' processes.

7.2. Research contributions to knowledge

The research aimed to contribute to existing debates in several ways. It has sought to provide original insights into the organisational and institutional contexts that underpin existing policy failures in managing water quality. As the world is rapidly becoming more complex, but also more urban, the peri-urban stands out as a representative example of this new order of complexity. In this context, worsening levels of water quality is a key environmental challenge facing many cities and peri-urban environments of the Global South, and is likely to be exacerbated in the near future. A discussion on how policy processes fail address water quality, and indeed how different actor groups construct policy is relevant. It is also important to explore some of the

critical insights this study has to offer with regards to addressing questions of sustainability and social justice in the peri-urban context.

The originality of this research rests initially with its overall approach. Whilst not being entirely ethnographic (since ethnographic research can often span several years of fieldwork), it has adopted and expanded upon important features of ethnographic research with to better understand different dimensions of the policy process. In particular, the research has tried to demonstrate in several instances that discourse is not impartial where the sustaining of current failures in resolving complex water quality challenges is concerned. Another way of engaging in this debate is by narrowing down the analysis to the predominant causes for policy failure and how these are attributed to the agency of multiple actor groups.

Furthermore it has provoked reasons for questioning entrenched commitments and practices as a necessary step for addressing peri-urban sustainability. Given that the peri-urban literature has generally placed greater emphasis on the relationship between land-use change and sustainability (cf.Douglas, 2006, Narain, 2009), this research has provided insights on a less explored aspect of sustainability. Land is indeed important, as some of the major changes taking place in the peri-urban context are underpinned by land related changes. However, shifting analytical attention from the issue of land to problems of deteriorating water quality, has brought to the foreground the relationship between knowledge, policy and formal decision-making, and has presented this as yet another area that merits attention for sustainability.

Part of the reason why the sustainability of peri-urban areas is often undermined has to do with how critical dimensions of the peri-urban context become effectively ignored in policy. This omission is in turn linked to the current mode of expert knowledge creation, and how legitimacy depends on where the knowledge is coming from. Exploring the different framings of water quality risk, which exist amongst citizens and science professionals, demonstrated this point. In the earlier theoretical discussion on risk (i.e. section 2.5), it was highlighted that conventional risk assessments focus on risks that are easily parameterisable, such as increasing emphasis on river pollution, or the technological options considered in order for policy to respond to river pollution, as discussed in section 4.4.3. However, they are poor at dealing with risks that are

characterised by ‘incomplete knowledge’(cf.Stirling *et al.*, 2007) such as the long-term effects of the biological and chemical contamination of drinking water sources.

Because of this misplaced focus on risk, peri-urban sustainability became undermined, and critical interconnections between water (access) and waste (water) that were central for peri-urban actors, were left markedly unrecognised at the national level. Throughout negotiations about peri-urban sustainability, policy agents have yet to reconcile their approach towards the different forms of knowledge which exist about the peri-urban context, as these different knowledges are often likely to represent different priorities for sustainability (Leach *et al.*, 2010: 64). A critical point that this study has attempted to communicate is that, if policy and decision-making effectively continues to ignore the different forms of knowledge which shape the peri-urban context, it becomes very difficult to create a more ‘inclusive’ vision of peri-urban sustainability. Such a vision would need to include an understanding of how different groups are represented in the process of addressing peri-urban sustainability; thus, taking a broader view of institutional responses, forms of expertise, and tools needed, for arriving at more sustainable peri-urban conditions.

In relation to the issue of social justice, the research has tried to argue that while environmental problems affecting peri-urban areas demand urgent attention, it is particularly those problems that are affecting the quality of life of the poorest groups that have been strikingly neglected in the policy arena. This is partly because issues of social justice have not been considered on a par with environmental sustainability. In order for this trend to be reversed, the thesis has identified that the understanding *of* and responses *to* impaired water quality of those living with or dependent upon contaminated water sources should have a more central role in shaping policy outcomes. It is equally important to legitimise NGO and civil society based water pollution monitoring initiatives that make stronger connections between water contamination and health effects on the poorest. A strategy of this kind, intended to benefit a particular social group that so far has been neglected in policy and planning of the peri-urban, is essentially a ‘political enterprise’ (Allen, 2003:146). Thus developing more socially just outcomes relates most obviously to the extent to which the participation of the poor themselves in the definition of priorities and decision-making can be achieved. This will not be an easy task, as the thesis has demonstrated, since part of the struggle in opening

up policy appraisal and implementation to poorer citizens is fundamentally about recognising the underlying power relationships that prevent marginalised people from having a greater voice and agency in policy.

Arguably, creating these sorts of connections between sustainability and social justice in the peri-urban interface has implications for other contexts where water quality is deteriorating as a result of rapid environmental and social change. For example, the ongoing pollution of water associated with the rise of oil extracting industries in many parts of the Amazon represents equally serious risks to the ecology of the Amazon and to human health, especially for the poorest people who use and consume contaminated water on an everyday basis (Bebbington, 2009). Currently different actors (oil companies, government actors, indigenous organisations working with citizens) struggle to obtained reliable information about measured levels of dangerous substances in polluted water (ibid). Hence, contests of knowledge are as 'alive' in this kind of policy process as they are in the peri-urban interface. Ultimately however, realising a broader normative notion of *sustainability* in this kind of context depends critically on the extent to which notions of environmental sustainability and social justice can be brought together when powerful forces are involved in shaping urban and peri-urban development, recognising that there are likely to be trade-offs between different actors' goals and aspirations with regard to sustainability (Leach *et al.*, 2010).

The strength of this study is the empirical insights drawn from the different cases, and not the construction of new theory. However, the empirical insights themselves imply a few modest contributions to existing theoretical debates, particularly in bringing together the policy studies and STS literature with the view to fostering a better dialogue between the two theoretical disciplines. In India, much attention has been directed towards 'experts' working within the bureaucracy, while their predominance in framing environmental policy has often been contested (cf.Williams and Mawdsley, 2006, Menon and Kohli, 2008). However, there have been fewer studies that have attempted to develop a better understanding of the underpinning discursive mechanisms and institutional commitments that ensure their predominance in policy. To this end, and by following the STS tradition, the thesis has taken a 'regulator's view' of the policy process and has highlighted that values, regulatory behaviour and the way experts 'manage' their relationships with other actors play a key role in their

maintaining a position of influence. By contrast, following the policy studies tradition enabled this study to broaden the focus and link a discussion on expert practice and knowledge to the peri-urban context, highlighting in the process that a two-way relationship exists between policy implementation and policy framing. The success of bringing together STS and policy studies rests fundamentally in showing that although policies are negotiated locally, local negotiations are also influenced by wider discursive frames, narratives and problem framings attached to national level actors.

The dialogue between STS and policy studies has further helped highlight a number of key entry points that could counter-balance some of the existing failures identified in the policy process. This links particularly to the idea that the functioning of the Board and State Boards could become more effective. The appointment of members should include other areas of expertise that are currently absent from both pollution assessments and the implementation of regulatory guidelines. Furthermore, the practice of regulating water quality needs to become more transparent, creating conditions where the regulators themselves are more open about the relative strengths and weaknesses of regulatory action. In addition, the research has identified specific potential entry points in the current structure that would allow the concerns of a wider range of stakeholders to be better represented in routine decision-making than at present. There is plenty of scope for translating the insights of this research into a summary of recommendations that can be used later to inform policy makers and regulators alike how prevailing approaches could become more pragmatic and responsive to local conditions. But this type of engagement can only take place if regulators are prepared to take up the challenge of making deeper changes in the existing regulatory regime.

Finally, the thesis' contributions to knowledge can be evaluated in light of previous research carried out on the peri-urban context. As discussed in the introductory Chapter 1, much ink has been spent discussing the particularities and commonalities of the peri-urban context. In the process valuable insights have been drawn from case study research in India and other countries, most prominently countries of the Global South, where peri-urbanisation has become more pronounced in recent years. On the basis of this research, we are now in a better position to evaluate environmental challenges brought forward by a broader process of economic and political change affecting the peri-urban interface (cf.Thong, 1995, Arabindoo, 2005), how peri-urban systems are

constituted in the first place (Moffat and Finnis, 2005, McGregor *et al.*, 2006), and the transformations rural and urban that act upon such systems (Baviskar, 2002, Kundu, 2008).

However, it is rather surprising that despite the relative rise in research focusing on peri-urban systems, this is an issue that still remains fairly marginal in mainstream policy and planning decisions. Part of the reason for this, in my view, is that a systematic analysis of the diverging ways of perceiving and analysing the peri-urban, in relation to specific resource management issues such as the impacts of water pollution, has not been granted sufficient attention by peri-urban scholars. Building constructively upon existing peri-urban theorisations, the thesis has therefore brought attention to two important areas which still remain relatively underrepresented in peri-urban research.

The first relates to the issue of scale. It still remains a critical challenge to understand the type of barriers that exist for 'mainstreaming' peri-urban considerations in policy and planning, and the different scales at which such barriers are likely to be manifested. So far, the peri-urban has been subject mostly to a 'place-specific' analysis, however the perspective offered in this thesis is essentially based on thinking 'across scales'. A cross-scale approach has helped identify policy spaces that exist 'outside' the geographical boundaries of the peri-urban yet can make a huge difference in shaping decisions around policy and planning on the ground. Notably, here, the role of the Board and the policy influence that it has achieved on issues related to water quality management over the years is of relevance since, as this study has shown it is a 'macro' policy space that could have a positive influence over the peri-urban, if for instance the particularities of the peri-urban context were fully integrated in the Board's decisions. However, what became clearly evident is that the Board can also be an 'obstruction' to mainstreaming the peri-urban in policy and planning, if particular biases that influence decision-making are not made explicit by involved actors, or are intentionally ignored for political reasons.

The second relates to the issue of knowledge. The approach commonly adopted to examine the peri-urban space emphasises the *institutions* formed in peri-urban areas such as, for instance, the range of formal and informal institutions that are usually formed for accessing basic water and sanitation services in the peri-urban context

(Davilla *et al.*, 1999, Allen *et al.*, 2006). In these accounts, a particular emphasis is placed on how institutional arrangements affect the long-term sustainability of peri-urban areas but also on the linkages between institutional arrangements and the quality of life and livelihoods of those citizens that reside in these spaces (Allen et.al, 2006:147). The insights offered by this study suggest that alternative *knowledge* based understandings of the peri-urban interface can also be of particular relevance, particularly when the influence of diverse knowledge systems is considered in the context of prevailing institutional arrangements, formal and informal. It provides an account of sources of incomplete knowledge in policy and management (i.e. in this case, specifically to do with water quality), and ways in which environmental risk and uncertainty (two critical issues in relation to the peri-urban environments) become embodied in different forms of knowledge production (i.e. 'expert' as well as 'lay'). Arguably, the issue of knowledge, and particularly locating knowledge both institutionally as well as geographically, is a subject that has received less attention both in urban and peri-urban debates, and where there are clear complementarities between the two. The thesis provides some prospect for moving towards that direction, while Chapter 3 has made explicit the methodological innovations and challenges of making knowledge a more central focus in peri-urban research.

7.3. Implications for future research

Water quality is traditionally a subject loaded with technicalities. Very little scholarly attention has been given to the ways in which water quality problems manifesting in transitional regions are, in fact, linked to a complex mix of institutional and knowledge factors. With this study having reached a natural close, a range of opportunities are presented for further research in this field.

This study has focused on two case studies in order to develop the key insights. The conclusions drawn from the case studies can only explain the overall patterns that underpin causes of failure to address water quality. However, at the same time, these cases do not allow a precise representation of the processes studied, and indeed there are other cases that could be included in the future in order to develop a better understanding of the issues. It would be of particular interest to explore the influence of international regulatory institutions' influence on the development of national

regulatory norms and guidelines. Global institutions such as the World Bank, the WHO, the Food and Agriculture Organisation (FAO) and United Nations Environment Programme (UNEP) may not necessarily directly impose regulatory norms for water quality on developing countries such as India, but they can indirectly urge the adoption of particular principles and 'best-practices' that are difficult for national regulatory institutions to ignore (Van Zwanenberg *et al.*, 2008: 8). One area of influence arises from the adoption of international water quality standards within national regulatory frameworks. Another important area could arise from the controlling of funds and expertise for project based activities already taking place within India by global institutions. River pollution abatement strategies especially have been heavily funded by donor agencies that are eager to make radical changes in the way water quality (specifically river pollution) is managed at present. Also, further research on global institutions and actors could support a better understanding of how the particular aspirations, visions and problem framings of actors at the international level could reinforce existing policy failures. Alternatively, if approaches developed at the international level could offer scope for the more integrated management of water quality, what constraints could hinder a process of scaling down these approaches to the local level? Both these issues deserve some further reflection since as far as the study findings suggest, any practical influence from international frameworks on the peri-urban was observed to be minimal.

This thesis has attempted to engage with policy processes influencing water quality priorities. It is possible however, that due to the thesis' emphasis on expert decision-making, other distinguishing features of the policy process may have been underrepresented. Or, put in terms of the theories applied, the attempt to make stronger links between policy studies and STS may have caused some of the conceptual elements that underpin studies on policy in particular to figure less prominently in the research. Leaving this limitation open is helpful since it provides directions for future research. Notably, the thesis has turned much of its attention towards the 'politics' of knowledge (particularly expert knowledge) but there are also political implications associated with the policies themselves. It is a very interesting line of inquiry, for instance, to look at how the urban middle-class can influence particular values and aspirations for strengthening environmental protection in towns and cities. This in turn is linked to what type of water quality changes are deemed necessary and important. Scholars in

Delhi have pointed out the dangers of middle class environmentalism in constructing an overtly sanitised vision of environmental protection that fails to incorporate the concerns of poorer groups (Baviskar, 2003). How are such visions co-constructed by different actor groups? What might be the role of the *media* in conjunction with civil society and policy makers in reproducing and legitimising such visions? There is also plenty of scope for future research on how business interests (and the power of industries) can gain undue influence over environmental protection measures. Empirically, this line of inquiry could perhaps focus much more on the interface between environmental regulators and industries than this study achieved. On a more general note, the point to be made is that matters of political economy in relation to water quality could be developed further in research terms.

Finally, a third potentially useful direction for further research to take would be to build upon the theoretical and empirical insights of this study in order to pursue an investigation of other relevant policy fields. In particular, expert knowledge related to air quality is another technical field that deserves much more focused scholarly study. Taking into consideration the Board's approach to water quality management, for example, it is possible to foresee overlaps with the design of prevailing air quality monitoring arrangements. A wider acceptance of the limitations of prevailing appraisal approaches (i.e. regarding the issue of selection of appropriate monitoring scales, language, and sources of knowledge,) could, in turn, form the basis for thinking in more concrete ways about specific tools that could encourage a more participatory style of engagement with impacts of water and air quality on targeted populations. For instance, work conducted in Indian towns and cities using spatial data (based on geographic information systems) and social surveys has been useful for identifying 'hotspots' of deprivation within large towns and cities (Baud, 2011). For the most part, such studies have been useful for mapping the extent to which anti-poverty programmes are, in fact, reaching those areas that they are intended for. It could be possible to imagine how similar methodologies could be developed to determine how pollution impacts variably upon different populations within urban and peri-urban areas. So from this point of view, there is significant scope for further research in terms of testing new types of methodologies and identifying specific entry points in the policy process, where these could be utilised for incorporating new information about the opportunities and limitations presented by the local environment, the social relations of power influencing

the distribution of risk from pollutants, as well as the concerns and aspirations of affected communities with regard to those risks.

To conclude, it can be hoped that the proverbial ‘our power rests with numbers’, a quote from one of the Board members, included also in the title of this thesis, ends up being challenged as both a rhetoric and professional practice ethic. Instead, as this thesis has argued, it is entirely possible that a more broad, varied and therefore socio-culturally embedded conception of water quality can become realised. Not only augmenting technical and specialised knowledge, but also creating pathways towards social justice and environmental sustainability, catered for by research objectives that policy makers and scientists alike might cultivate, develop and enforce.

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Appendix 1: Interviews with Board members, activists and scientists in Delhi, case 1

1. Mr. Sinha, chairman of the Board
2. Dr. Patel, additional director of the Board
3. Dr. Joshi, (former) additional director of the Board
4. Dr. Verma, senior laboratory scientist of the Board
5. Dr. Rao, senior chemist and additional director of the Board

1. Dr. Desai, senior scientist and director of PAMS division of the Board
2. Dr. Bhatt, senior scientist, PAMS division of the Board
3. Dr. Modi, senior scientist, PAMS division of the Board
4. Mr. Raj Kumar, environmental engineer, PCI division of the Board
5. Mr. Manoj Tanti, senior environment engineer, PCI division of the Board
6. Mr. Ajay Prasad, environmental engineer, working for IIT in New Delhi
7. Dr. Khamar, retired engineering professor living in New Delhi
8. Mr. Raghavendra, retired pollution scientist living in New Delhi
9. Mr. Lalit Rao, senior climate scientist working for IIT New Delhi
10. Mr. Sunil Mehta, engaged activist and journalist based in Chennai
11. Mr. Leo Saldanha, environmental activist based in Bangalore*
12. Mr. Dunu Roy, director of Hazards Centre, an NGO based in New Delhi**

*** Real name used with permission**

**** Real name used with permission**

Appendix 2: Interviews with officials, citizens, and activists in peri-urban Ghaziabad, case 2

1. Mr. Jadav, director of the UPPCB regional office
2. Mrs. Roy, scientific officer at the UPPCB regional office
3. Mr. Vivek Nain, assistant engineer at the UPPCB regional office
4. Mr. Surya Joshi, official of the Water Board (Jal Nigam)
5. Mr. Vivek Ramesh, chief engineer for the Ganga Jal water treatment plant
6. Mr. Neeraj Kumar, water engineer of the Water Board (Jal Nigam)
7. Dr. Saraf, chief medical officer of the Ghaziabad Hospital
8. Dr. Shastri, coordinator of the IDSP, Ghaziabad Hospital
9. Miss Riya, IDSP officer of Ghaziabad Hospital
10. Mr. Anand, chief town planner for the Ghaziabad Development Authority
11. Mr. Ajay Kadam, Municipal Commissioner of Ghaziabad
12. Mr. Sen, senior engineer for the Central Groundwater Board
13. Elderly woman resident of Ambedkar Nagar slum settlement
14. Village elder, resident of Ambedkar Nagar slum settlement
15. Farmer and resident of KarKar Model urban village
16. Resident of KarKar Model urbanised village
17. Resident of Nawada urban village
18. Resident of Maharajpur urban village, Sahibabad industrial area
19. Mr. Sushil Raghav, environmental activist based in Ghaziabad*
20. Mr. Venkataraman, resident of Indirapuram, and New Delhi advocate**

*** Real name used with permission**

****Real name used with permission**

Appendix 3: Example of the interview schedule

1. Interviews with Board members

Eliciting respondents' profile

Ask for name of interviewee, area of expertise and position in the organisation, number of years spent in the organisation, professional roles other than the Board.

Introductory questions

How do you see the role of the Board in terms of addressing water pollution?

What policy guidelines influence how financial and time resources are spent to address water quality management?

To what extent does the structure of the organisation (i.e. in terms of divisions, infrastructure, and expertise) influence the projects you work on (for example more work on national air, water quality monitoring)?

What stakeholders do you normally liaise with on the subject of water pollution?

In recent years have you been working on projects/initiatives (mention examples?) that signify a change in organisational thinking over addressing pollution issues?

Working as a scientist in the Board (regulatory/advisory) you may have to perform different sets of activities that are not necessarily related to your expertise….if so can you discuss a bit on the nature of these responsibilities?

Questions specific to water pollution monitoring

What types of issues are you usually concerned when developing a monitoring strategy (i.e. for water pollution)?

Does that involve fieldwork activities? (Going to poorer communities?)

How often would you need to go to the field?

When water samples come from outside agencies, what is the scientific rationale for testing the quality of the water?

When it comes to water pollution, why have you focused primarily on large scale river basin studies?

When it comes to particular problem areas (i.e. Ghaziabad) do you consult local regulatory bodies to develop a pollution abatement strategy?

What happens when a water quality concern overlaps with the responsibilities of another agency (i.e. Groundwater Board, municipality, health departments)?

How robust are effluent emission standards (as a regulatory 'tool') in minimising pollution impact, (taking into account connections between pollution, health, ecology, sustainability environment)?

Do you think that incorporation of social science research methodologies and expertise can have a positive impact to your work. Is that something that CPCB would consider? (Considering that the majority of people working in CPCB are scientists)

Water pollution regulation

Can you intervene at the state level when a particular problem area is not addressed properly (i.e. industries operating illegally in Ghaziabad)?

What would be the role of the CPCB in this case?

Would it result to particular actions being taken? Or does that depend on other agencies/authorities co-operation (i.e. District Magistrate, Municipality)?

Do you feel that your organisation is sufficiently equipped in terms of manpower and financial resources to regulate water quality affectively?

Would it make sense in your opinion to give greater autonomy at the state level for developing standards?

Eliciting Board members' views on citizen participation in formal decision-making

Under what circumstances do you seek the consultation of the public or citizens/communities affected by impaired water quality?

How can the public become more informed/and proactive in decision-making?

What type of institutions do you normally share your data with (policy makers, NGOs, universities, other?)?

While the general public is more aware of the functions and activities of the Board, there is little awareness at the 'state' and 'district' level on the roles of State Boards.

This often leaves pollution-affected citizens powerless in terms of seeking solutions to their immediate concerns. How do you feel the role of the State Boards could be improved, as well as the interaction between the State Boards and your own organisation?

2. Interviews with officials in Ghaziabad district

Eliciting respondents' profile

Ask for name of interviewee, area of expertise, name of the organisation, professional responsibilities. State aim of this study is on eliciting the personal views of officials working in Ghaziabad district about the problems of water pollution affecting the area.

Introductory questions

How long have you worked in this district?

Have you seen any significant changes taking place in this area over recent years?

What do you think is contributing to the degrading environmental conditions of this region?

Are there any particular areas (related to local environment) that you find to be of more concern than others?

Questions applicable to all fields of experts/officials

In your organisation what are the key initiatives (and policy interventions) that you are focusing on (is there an obvious link with water quality?)?

When did the initiatives start? How long have they been running for?

What sort of social groups do these activities normally target (i.e. residential areas? villages?)?

Water pollution regulation

What type of pollution issues do you focus upon?

Do you have a team that conducts field visits? (How often do you visit affected areas?)

What activities do you need to regulate more closely (i.e. river basins, industries?)?

Do you have the power to close down an industry that is not conforming?

Official views on community level water quality concerns

How is your organisation involved with improving the environment in villages and slum settlements?

Do you (or your teams) make field visits to these areas? How regularly?

Do you talk to community about the problems, or do you get information from local doctors and representatives?

Do you have information on pollution problems affecting these areas?

Is there a dialogue amongst official agencies on pollution issues affecting the villages and slums?

How informed do you think the communities are in terms of government efforts (immunisation, water treatment filters, other options?)

Appendix 4: Right to Information Act Letter

क्षेत्रीय कार्यालय - उ0प्र0 प्रदूषण नियंत्रण बोर्ड, गाजियाबाद
REGIONAL OFFICE, U.P. POLLUTION CONTROL BOARD, GHAZIABAD

संदर्भ सं0 : 4081 RTI 138/10 दिनांक 21-4-10

To,

Regd. Post

Mr. Sushil Raghav,
Karkar Model, Post-Sahibabad,
Ghaziabad.

Sub: Regarding the application received on date 23.03.2010 under the Right to Information Act, 2005.

Dear Sir,

There are the informations as applied under the RTI Act, 2005 as per record.

1. The are 304 no of units under category 44 of polluting nature having NOC to operate (Consent) from the Board.
2. There are 15 no of units, ~~units~~ under cat-44 of polluting nature that are generally not complying with the pollution control norms.
3. Ground water quality measurements are attached in Annex.-1.
4. Industries of Sahibabad Industrial Area, Site-4, used ground water for industrial process.
5. M/s Rohini Chemicals, 54/1/3, Site-4, Sahibabad Ind. Area, Ghaziabad used ground water for industrial process.
6. Copy of Water Cess bill is attached in annexure-2.
7. Required information is served as annexure-3.
8. Standards of treated effluents are mentioned in annexure-3.
9. As per point 7.
10. Under Water/Air Act, Consent is applied for year 2010. Consent application is under process.
11. Required information is served as annexure-4.

These informations are served to you under the provisions of the Right to Information Act, 2005.

Regards.

Encl: As Above.

Yours faithfully,

Regional Officer

Copy to

C.E.O., Circle-1, U.P. Pollution Control Board, Lucknow for information & necessary action please.

Regional Officer

rti.doc/Jk/07

क्षेत्रीय कार्यालय : आई.एन.एस.-2, सेक्टर-16, वसुन्धरा, गाजियाबाद - 201 012, फोन/फैक्स : 0120-2883720
मुख्यालय : पिकप भवन, तृतीय तल, विभूति खण्ड, गोमती नगर, लखनऊ - 226 010
Website- www.uppcb.com, e-mail : info@uppcb.com